Accelerating Transformation through Health Information Technology

Summary of Findings from the CHT Connectivity Conference, October 18, 2005
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Foreword

Newt Gingrich,
Founder of the Center for Health Transformation

As we recover and rebuild in the wake of Hurricane Katrina and its aftermath, we must take this opportunity to move healthcare into the 21st century. We have seen that our current system cannot cope with an extreme disaster like Katrina or a natural pandemic such as avian flu, nor will it be able to respond to a terrorist attack involving weapons of mass destruction. An interconnected, community-wide health data exchange is an essential component of a system that can. Health information exchanges and regional networks are vital foundations upon which to build.

Our current system is largely a 1950s model of static paper records stored in filing cabinets, warehouses, and hospital basements. It cannot effectively monitor and alert officials to a public-health crisis, such as a disease outbreak, and it cannot follow survivors as they are relocated to other states. These facts endanger the lives of our citizens.

What is Congress' response? Indications are that our representatives will table pending legislation on health information technology, even though it is an absolutely vital step to averting many of the healthcare tragedies and challenges we faced in the aftermath of Katrina. Several of the current proposals would foster the creation and development of regional health information organizations with grant funding, regulatory reform, and by driving adoption of technology. If Congress fails to pass such legislation this year, they will miss a critical opportunity to save lives.

To put it simply, in today's world a modernized, interconnected healthcare system is a national security necessity. The plight of New Orleans and all the citizens of the Gulf Coast is a window to tomorrow if we do nothing today. We must be prepared.

A 21st Century Intelligent Health System is the key to preparing for an extreme disaster. Currently, if there were a public-health crisis, how would we know? Our current approach is posted on the web site of the Centers for Disease Control and Prevention (CDC). The CDC advises citizens to "immediately report any symptoms to health professionals." This is not so different from the approach used during the yellow fever epidemics of the 19th Century. On the other hand, a modernized, interconnected system like a health information exchange could monitor patient data for potential disease outbreaks and automatically alert officials. An interconnected system could electronically track medical visits and specific symptoms; identify where pockets of disease outbreaks are located; research where the victims originated; and determine possible causes. The earlier we can detect a public-health crisis, the better the chance of containing it and saving lives.

This must happen now. Recent studies of the 1918 flu pandemic, which killed an estimated 50 million people worldwide, concluded that a deadly strain of avian flu was the killer. Scientists at the U.S. Armed Forces Institute of Pathology, the CDC, and the Mount Sinai School of Medicine found that the current avian flu virus, which has killed millions of birds and more than 60 humans so far, possesses some of the same mutations as the 1918 strain. The dangerous similarities between 1918 and now, combined with the ease with which deadly diseases can spread, as the Severe Acute Respiratory Syndrome (SARS) scare proved several years ago, should be an urgent wake-up call to industry and policymakers that decisive action is needed now.

The federal government is taking notice. Health and Human Services Secretary Mike Leavitt recently chaired the inaugural meeting of the American Health Information Community, a 17-member commission charged with expediting the adoption of health IT and determining data standards for interoperability. Commenting on the threat of pandemics, Secretary Leavitt noted how community-wide networks are part of the solution. "I want a system that will stream emergency room data from local, state, and national health authorities multiple times a day," he said.

Health information exchanges are the foundation upon which to build such a system. They seek to connect all stakeholders in a community – from hospitals, doctors, and nurses to health plans, pharmacies, and laboratories. By sharing real-time data, health information exchanges can pinpoint potential situations before they reach a crisis.

As many as 1.3 million citizens from the Gulf Coast were displaced by Hurricane Katrina. If terrorists succeed in exploding a nuclear device in an American city, we could see an even greater displacement. Today's survivors already have begun to rebuild their lives, and unfortunately, they must rebuild their healthcare history as well. Hundreds of thousands of paper medical records were destroyed in Katrina's fury. Survivors have no documented medical histories, no medication history, no treatment regimen, no test results – no clinical documentation of any kind.

How can healthcare professionals properly care for evacuees with no information? Think of the AIDS patient who was taking an intricate combination of drugs to prolong his life. Think of the elderly man who was taking multiple prescriptions to treat a host of chronic conditions. What about the woman who was in the middle of radiation treatment for cancer – what will she do now that her paper medical record has been washed away?

Many citizens have received some kind of healthcare since being displaced, whether in a community health center or in a Red Cross shelter. Unfortunately, without an interconnected system or even an online Personal Health Record to digitally capture this information, the record of the interim care that they received will likely never be integrated into those individuals' ongoing permanent medical record.

Health information exchanges can back up medical data so it can be safely preserved in the event of natural or manmade disasters, unlike the paper records of today. Community-wide networks can give clinicians remote access to patient health records should their specific facility be damaged.

In the wake of Katrina, the Department of Veterans Affairs (VA) demonstrated the power of electronic health records in action. As the hurricane barreled towards the Gulf Coast, the VA made final backup copies of tens of thousands of electronic health records for their veterans in the region. Unlike the hundreds of thousands of citizens who received care with little or no documented history, when these individuals began arriving at VA facilities in Texas, Florida, and other states across the country, their full medical histories were intact and available immediately.

This is the kind of technology we need today. A community-wide, digital healthcare system is an absolute necessity to respond to an extreme disaster and adequately care for patients in its aftermath. These dangers exist, and natural pandemics or terrorist attacks are very real threats we can't ignore. For the sake of our country and all our citizens, we must take decisive action to build a modernized, interconnected healthcare system – and regional health information organizations are vital building blocks for creating that system.

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I. Executive Summary

On October 18, 2005, the Center for Health Transformation and IDX hosted the CHT Connectivity Conference: Accelerating Transformation through Health IT. We met our goal of highlighting for industry leaders and policymakers the successful efforts underway to modernize healthcare communities across the country through health IT. These health information exchanges, or regional health information organizations (RHIOs), are indeed the building blocks to create the National Health Information Network, a secure, interoperable system where all stakeholders involved in an individual's care can appropriately access and share electronic health information in real time at the point of care.

Drawn from the insights of attendees participating in the conference, this report captures best practices from today's successful and emerging RHIOs, including those based in predominantly rural areas and those in multi-provider urban environments. We outline practical, road-tested approaches to establishing a RHIO and also outline priority legislative actions that are needed to accelerate the growth of RHIOs and build a 21st Century Intelligent Health System.

A 21st Century Intelligent Health System

A modernized, interconnected system will undoubtedly save lives and save money. Study after study, most recently by RAND in *Health Affairs*, conclude that an interconnected system will save more than $80 billion a year,[1] while the Institute of Medicine has repeatedly emphasized that electronic health records and related technologies are vital to preventing medical errors. [2]

An interoperable network will be a critical line of defense to detect and properly respond to a natural pandemic or terrorist attack using weapons of mass destruction. A digitized healthcare system will provide clinicians and caretakers with up-to-date and real-time information at the point of care. A transformed system will give the research world a wealth of de-identified data to mine for best practices and new treatments. And such a system will boost efficiency and cut costs by eliminating waste, reducing fraud, and automating many tasks. What's more, such a system offers higher degrees of patient privacy than possible with paper records, given the availability of password protection, biometric fingerprinting, and electronic audit trails that document every individual that accesses the record.

These are the hallmarks of what we call a 21st Century Intelligent Health System. For the sake of our country and the health and healthcare of all citizens, we can and must build it.

Building the system of tomorrow requires action today. Political forces, proprietary interests, technical barriers, and a lack of funding are significant obstacles – but they can be overcome. All stakeholders must take decisive action to:

- Drive adoption of electronic health records and other health information technologies;

- Reach industry consensus and convergence on data standards for interoperability;

- Reform the regulatory framework at both the state and federal levels to expedite the adoption of health IT and encourage the creation of health information exchanges;

- Develop and institute best practices to safeguard patient privacy, including ensuring a consistent national law to protect privacy of data used in RHIO activities;

- Engage consumers on using health IT in their health management. The Center for Health Transformation advocates that every American have an online personal health record by 2006, and;

- Facilitate the research of de-identified clinical data for new treatments, better therapies, and improved knowledge.

Health Information Exchanges

Innovators at the local and regional level are not waiting for others to resolve these issues. Hospitals, doctors, technology vendors, health plans, state and local governments, employers and consumers are collaborating in hundreds of communities from coast to coast to build health information exchanges for the betterment of individual health.

The federal government sees the value in these efforts. The U.S. Department of Health and Human Services recently awarded four contracts worth nearly $20 million to build prototypes for a national health information network.[3] Technology leaders such as Microsoft, Cisco, IBM, CSC, and Sun Microsystems will work with RHIOs from across the country, including the Indiana Health Information Exchange and HealthBridge, two leading RHIOs that were featured at the CHT Connectivity Conference and are detailed in this report.

The characteristics of RHIOs differ greatly from one to the next. Differences abound in geographic location, size, scope, sophistication, and stakeholder involvement. There is no single recipe for success. However, the experiences of health information exchanges from across the country will be invaluable as we progress toward building the National Health Information Network.

While there are significant differences between RHIOs, we have identified five crucial areas all efforts must address if they are to succeed: financing, health management, privacy and security, interoperability/infrastructure, and cultural change.

Financing is critical to every business – local and regional healthcare networks are no different. These initiatives must bring value to their communities, participating organizations, and perhaps most importantly, they must bring value to the consumer. But to build such a network, proper funding is needed. Many health information exchanges have relied on grant funding as their primary revenue stream. In the long run, with little hope for large federal investments, this business model is not viable. Health information exchanges must be independent and self-sustaining, and their operating costs must be borne by all participating stakeholders. Hospitals often function with wafer-thin operating margins (averaging 3 percent during the affluent final years of the 1990s, for example) and cannot be the sole supporters of RHIO efforts. However, RHIOs deliver cost benefits to hospitals by replacing costly mailings of diagnostic test results with electronic distribution, offering them a significant return on investment. If the value of a RHIO is demonstrated to its community, the market will ensure its financial viability.

The key promise and payoff from a connected healthcare community is improving the quality of care that all patients receive – from reducing medical errors to monitoring chronic conditions to discovering new treatments. RHIOs must be designed so that clinicians exchange patient data in real time for use at the point of care. Changes of this magnitude are always disruptive. That is why RHIOs must be designed to complement workflow rather than complicate it. By data-mining patient health information we will yield new breakthroughs in treatments, therapies, and understanding of disease that will transform the practice of medicine.

Health information exchanges must make privacy and security a top priority. If personal health information is not secure, if consumer privacy is not adequately protected, the network is doomed to fail. A uniform patient identifier is part of this process. By ensuring that the right patient's information is pulled at the right time, both clinicians and patients will have confidence in the RHIO. The public can be convinced that their electronic information is accurate, confidential, and secure. One step in the right direction is to dramatically toughen the penalties for hacking into electronic medical files and making slander laws applicable to publishing or posting online any personal health information.

Connecting a healthcare community means developing technologies so that all stakeholders can share information in real time: hospitals, pharmacies, physicians, nurses, long-term care facilities, health plans, and consumers. This is daunting – but it can be done. The technical architecture will differ from one RHIO to another, but the use of common data standards will not. Through their experiences and successes, RHIOs can push the industry to reach consensus and convergence upon common data standards that will help achieve interoperability. This must be done with existing systems in mind. Data standards must be designed so that current technologies can be upgraded to meet new requirements, rather than forcing providers to replace current systems and start from scratch.

We are on the cusp of enormous change in health and healthcare, both technologically and culturally. And change of this magnitude is never easy. It is always disruptive. It replaces existing paradigms and creates uncertainty. But the level of difficulty should not dissuade us from progress. We must have in healthcare the same level of technological advancement that we embrace in all other sectors of society. Getting there will most assuredly upset comfortable routines. It will force entrenched stakeholders to change. And yet it is absolutely necessary because in the end it will save lives and save money.

Our goal is a fully interoperable, interconnected healthcare system where all stakeholders can exchange patient information in real time to use at the point of care. As industry stakeholders come together in communities across the country, we will find answers to the pressing questions of financing, interoperability, privacy and security, cultural change, and health management. Such a system will indeed improve consumer health, reduce costs, and build a brighter future for America.

II. Recommendations

The CHT Connectivity Conference: Accelerating Transformation through Health IT generated key recommendations outlining policy priorities, industry imperatives, and practical strategies for healthcare organizations embarking on RHIOs.

Congressional Action

- The Congress should pass comprehensive health IT legislation this year, and it must include clear-cut, straightforward exceptions to Stark and Anti-kickback statutes for health information technology. On November 17, 2005, the Senate unanimously passed S. 1418, The Wired for Health Care Quality Act. While this bill does not include Stark and Anti-kickback exceptions, it is a good first step towards making health information technology the priority it should be on Capitol Hill. The House must now lead and pass a strong, bipartisan bill that will allow for the rapid and widespread adoption of health information technology, foster the creation and development of RHIOs through grant or loan funding, and reform key regulatory barriers that stand in the way of progress.

Financing

- The Center for Health Transformation advocates that federal government should dedicate 1 percent of all discretionary spending – roughly $7 billion a year – to health information technology. Health IT is vital to reducing medical errors, which kill nearly 100,000 Americans annually, according to the Institute of Medicine. It is also essential to increasing preparedness for and response to extreme disasters. For these compelling reasons, health IT warrants the same levels of support as national security.

- Until more federal support is available, emerging RHIOs should explore market-based financing models, including using aggregated health data to support clinical research and health management projects or developing pay-for-use programs with participating caregivers.

- Emerging RHIOs should pursue both public and private funding sources, such as grants and loans, for start-up capital, but long-term financing must come from sustainable models, not grants. Support from industry stakeholders is very important to secure their true commitment, rather than their simple endorsement.

- RHIOs should look for opportunities to partner with and seek capital from health plans, given the significant benefits of more coordinated care to healthcare costs.

- The industry as a whole should move to a financing model that rewards healthcare organizations for positive patient outcomes and preventative care, not for the volume of care they deliver.

Health Management

- Guaranteeing patient safety must be a core principle of every RHIO. Measuring, monitoring, and analyzing processes within facilities and across communities will allow RHIOs to capture data and use it to improve the delivery of healthcare. This technology must be embedded in the foundation of RHIOs from the beginning because, at their most fundamental level, RHIOs are about saving lives and improving care.

- By capturing health data across entire regions, RHIOs provide the electronic foundation for efforts to proactively manage the care of individuals with chronic disease and support large-scale preventive care initiatives that keep consumers healthy, control infectious disease outbreaks, and circumvent expensive visits to the hospital. Too often, clinicians must provide care for a patient without having access to the individual's full health record, a risky situation known as a "blind encounter." These situations could be virtually eliminated by making electronic patient data available to authorized emergency room clinicians and other providers.

- We need to change the way healthcare providers are reimbursed so that we reward physicians and healthcare organizations that keep their patients healthy. Health should come before healthcare. Chronic disease management programs offer a crucial opportunity to reduce mortality, improve quality of life, and reduce costs. These programs require access to health data from large population groups, in order to effectively measure progress in patient outcomes.

- In order for health management initiatives to work, consumers must be engaged in their health and healthcare. Personal health records are an effective way for individuals and caretakers to review their medical history, learn about chronic conditions and new treatments, refill prescriptions, and communicate with their clinicians online. The Center for Health Transformation advocates that every American should have a personal health record by the end of 2006.

Privacy and Security

- The federal government should ensure that health information is protected across state borders by creating a common regulatory framework for health IT – including privacy safeguards – that will preempt state privacy and security laws. At the time of publication, The Health Information Technology Promotion Act of 2005 introduced by U.S. Representative Nancy Johnson (R-CT) outlines a roadmap that will accomplish this.

- In addition to creating a single set of national guidelines for information privacy, the malicious use of personal health information should be a federal crime that carries steep fines and mandatory jail sentences. Congress must adequately fund enforcement of these laws, punishing those who inappropriately access, share, publish, or post any medical file or personal health information.

Technical Infrastructure

- Vendors must ensure that their electronic health record software complies with emerging interoperability standards. In addition, vendors should upgrade their systems to incorporate a service-oriented architecture. A service-oriented architecture intrinsically enables data to be exchanged with other information systems via Web services, which dynamically exchange data between systems, according to agreed standards, without requiring costly interfaces.

- Addressing the issues of interoperability and technical infrastructure are crucial to regional health networks. The industry must link disparate EHR software systems, and advance solid and secure structures for patient data exchange.

- The healthcare industry currently has many different types of technical standards for representing clinical data. These standards often conflict and overlap. To address this problem, the U.S. Department of Health and Human Services created the Health Information Technology Standards panel, which will harmonize the major health IT

standards across the industry. However, aggressive timelines are required to resolve standards issues in a timely fashion. It is widely recognized that a minimum set of standards should first be approved, with future elaborations that extend to enable fully interoperable electronic clinical information.

- RHIOs developed by organizations with different IT systems in place should consider creating a neutral governing body, such as a 501(c)(3) organization, that serves as a central resource for addressing standards challenges and appropriately reconciling data. Providing start-up funding for such organizations should be a high priority for payor and provider organizations, the donor community and federal and state governments.

Cultural Change

- RHIO organizers must use change management strategies to address the cultural resistance inherent in any significant transformation. These programs should include enlisting clinicians in the adoption of EHR systems and planning for RHIO initiatives; educating and involving consumers; communicating positive patient safety and cost-savings outcomes; and providing enough information online to make the system worthwhile to stakeholders.

- RHIOs also must resolve issues of competition between healthcare organizations. Solutions may include identifying an impartial facilitator, or establishing a collaborative based on the shared goals of participants.

- RHIOs should engage large employers from the beginning. Not only do employers have an incentive to push for a modernized system because of the dollars they will save, they must drive transformation because the lives and health of their employees is at stake. Employers must leverage their purchasing power to move providers, health plans, and consumers to change. Participating in health information exchanges is an important way to do this.

Operational Strategy

- Many existing successful RHIOs have begun by introducing clinical messaging, enabling physicians to electronically receive and review patient results. Electronic availability of emergency department data is another much-needed service. RHIOs should consider both clinical messaging and support of emergency care as pragmatic first steps for data exchange initiatives.

Advocacy

- Healthcare organizations involved in RHIOs should proactively reach out to elected officials and the media, ensuring that the public and policymakers at all levels of government are aware of both the benefits of RHIOs and of local activities underway.

- RHIOs should measure the potential return on investment of electronic health information exchange, including cost savings by replacement of paper processes, potential reductions in adverse drug events, and other metrics, and provide this information to the public, media, and policymakers at all levels of government.

III. Introduction to Regional Health Information Organizations

A. Cursory Review of RHIOs Across the United States

High-quality, efficient, and cost-effective healthcare delivery in the United States depends on the creation of a consumer-centric electronic health record (EHR). This must enable the secure, rapid and reliable exchange of information among all members of the healthcare team. Because an individual may see multiple providers at different institutions – even in different cities over the course of a lifetime – this record needs to work across a range of healthcare settings and even across disparate geographic locations.

One solution being spearheaded by the federal Office of the National Coordinator for Health Information Technology (ONCHIT) is a National Health Information Network that will ensure nationwide interoperability among EHR systems. The National Health Information Network could make critical medical information, including allergy and medication lists, instantly accessible in any emergency department anywhere in the United States, so that clinicians can make better decisions when time is of the essence. It could also enable telehealth, allowing virtual teams of clinicians to collaborate on a patient's care from multiple sites, linking, for example, remote rural hospitals and specialists at distant tertiary care facilities.

The building blocks for a national network begin with RHIOs. These collaborative efforts that span whole communities, states, or even multi-state regions will improve the quality of patient care by linking all caregivers together, from large and small provider organizations to health plans, pharmacies, public health entities, and other healthcare professionals.

By sharing individuals' electronic data, RHIOs support disease management programs and other preventive care initiatives that proactively treat chronic conditions such as diabetes and heart disease. And developing regional health information exchanges offers unprecedented opportunities to identify and respond to national security events, including bioterrorism outbreaks, as well as public health crises such as a potential outbreak of avian flu.

The early progress on RHIOs today is a far cry from the community health information network (CHIN) movement of a decade ago. While the goal of health information exchange is common to both, there are some important differences that account for the disparity in result. Ten years ago, the technology infrastructure to support such a project did not exist. Relatively few physician practices had yet invested in personal computers; broadband Internet access was not widely available; and hospitals were not equipped to provide wireless access to electronic records via portable devices such as PDAs or laptops.

A decade later, not only is much of the technical infrastructure in place, there are other powerful forces at work. Healthcare costs are hammering employers, government, and consumers alike, and health IT has demonstrated that it can improve efficiency, boost productivity, and thus save money. The Institute of Medicine's landmark study and subsequent follow-up estimated that up to 100,000 Americans are killed every year by medical errors[4] – a fact that health IT systems would virtually eliminate through clinician decision support, patient safety monitoring, and automation.[5]

Additionally, electronic privacy and security systems have grown in sophistication, so they are now able to address the public's fears about confidentiality. And, perhaps most importantly, government support for a national health information infrastructure extends all the way to the Oval Office. President Bush's 2004 executive order establishing ONCHIT marked the beginning of a

new era for health IT. The President charged ONCHIT with the mission to adopt a national electronic health record infrastructure within the next ten years.

The diversity of successful RHIOs operating throughout the country shows that there is no single prototype for a health information exchange. Models range from a co-op of organizations actively sharing consumer data, to a single provider institution offering technology services and EMR access via an Application Service Provider (ASP) model, to a consortium that serves as a facilitator for competing providers and payors in a single area.

The structure of each RHIO, as well as its funding sources, data-sharing strategies, and the types of technology adopted are determined by the needs, opportunities, and challenges unique to each region. Factors include the types of participating institutions, their size and technological sophistication, the driving forces and leadership behind the RHIO, and even the geography of the area and distance between providers. On the technical side, interoperability is in many ways the most complex and most important requirement in the formation of a RHIO.

At the tactical level, every RHIO must address technical issues to ensure that participants can efficiently and effectively transfer electronic data from the bedside to the caregiver across town. As RHIOs link the disparate systems of public and private healthcare providers, and even some health plans, they need to ensure that their systems are interoperable and can communicate with each other. On the technical side, interoperability is in many ways the most complex and most important requirement in the formation of a RHIO, given the goal of supporting a national infrastructure for health information exchange.

Some RHIOs have met the interoperability challenge by partnering with a single technology vendor to build a homogeneous system, ensuring that software supporting care in the doctor's office readily integrates with the EHR in acute care settings. Heterogeneous and homogeneous models offer different strengths for different regions, depending on the demographics of each region, and whether it is dominated by a single healthcare provider or disparate providers. However, interoperability will be an increasing prerequisite as the nation moves towards a national health information infrastructure.

Heterogeneous models that have brought together providers using a variety of systems from different vendors and service oriented architecture software find ways to structure the data, or to overlay existing standards such as HL7 in order to promote data exchange. At the industry level, many vendors and vendor organizations such as the Health Information Management Systems Society (HIMSS) EHR Vendor Association are collaborating with organizations such as the Certification Commission for Healthcare Information Technology (CCHIT), and the Health Information Standards Technology Panel (HITSP) to develop standards and certify software that allow for data exchange and promote interoperability. The establishment of true nationwide interoperability standards, and incentives for their adoption on both the industry and provider side, are the key requirement for long-term viability of RHIO organizations and the technology that supports them.

Funding also is a significant issue, particularly for provider organizations. Our current healthcare system rewards providers for the *quantity* of procedures they perform rather than for the *quality* of care that they deliver. In other words, providers are paid more for treating sicker patients who have multiple acute episodes rather than keeping them healthy and out of the doctor's office. Furthermore, the current payment structure does not encourage and incentivize the adoption of EHRs and other technology that will eliminate duplicate tests, reduce the length of hospital stays, and lower the overall cost of care delivery.

Aligning funding and economic incentives is critical to the success of RHIOs. The industry must move away from a transactional funding structure based on volume to a quality of care model that

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is based on prevention and performance. For example, the federal Centers for Medicare and Medicaid Services is working with provider organizations to demonstrate the value of proactively managing care for seniors with chronic conditions such as diabetes, coronary artery disease, congestive heart failure, and hypertension. And we at the Center for Health Transformation will in 2006 launch the Bridges to Excellence diabetes and obesity program in Georgia.

These pay-for-performance programs provide incentives for reducing the cost of emergency and inpatient care through more aggressive preventive care, partly through increased use of decision-support and other sophisticated healthcare technology in a variety of healthcare settings. RHIOs that develop EHRs spanning the care continuum will enable providers to better track outcomes across inpatient and ambulatory visits and assess the actual *value* of the care provided.

In addition, efforts by the government to reform Stark and Anti-kickback statutes and other laws that unintentionally restrict RHIO development will help open private funding sources to support these initiatives.

The variety of approaches to RHIOs around the country demonstrates the extent to which strategies and tactics are dictated by the unique environment in which each is operating:

- **CalRHIO.** CalRHIO started in January 2005 as a project of the Health Technology Center to support RHIO efforts around California. As an umbrella organization, CalRHIO's approach is incremental: first, to catalog existing RHIOs; to support new and existing RHIOs by acting as a clearinghouse for best practices; and to provide a neutral environment that will foster discussion among stakeholders and incubate the development of new RHIO projects. California's sheer size – both in terms of geography and population – means that CalRHIO encompasses an unmatched range of rural and urban settings.

- **CareSpark.** In rural central Appalachia, CareSpark is building a secure network that allows physician offices, hospitals, public health departments, pharmacies, laboratories, and imaging centers to communicate electronically. Historically, the region has a high rate of chronic illnesses such as diabetes, asthma, and heart disease, and a correspondingly high death rate for people under the age of 65. CareSpark grew out of a decade-long effort by a local non-profit citizen organization to develop collaborative processes to improve the health in the community. Today, CareSpark receives support from nearly 30 organizations, from BlueCross BlueShield of Tennessee and Eastman Chemical Company to John Deere Health and East Tennessee State University.

- **HealthBridge.** HealthBridge began in 1997 as a community-wide physician portal for the greater Cincinnati area with funding from five health systems and two insurers. Since then, the organization has added clinical messaging functionality, public health and physician alerts, and syndromic surveillance, and is in the process of implementing electronic order entry in ambulatory offices. As a result, HealthBridge's participants have documented substantial outcomes in patient safety, clinician efficiency, and cost savings. Encompassing 14 counties in three states, HealthBridge is a truly regional effort, defining its reach by the medical referral area, rather than by political boundaries.

- **Indiana Network for Patient Care (INPC).** This network is a collaboration of hospitals, physician practices, laboratories, radiology centers, health departments, and other stakeholders. Initial funding came from federal grants, but in 2004 the not-for-profit Indiana Health Information Exchange (IHE) was created to establish sustainable business models around the INPC. IHE plans to create a common, secure, electronic infrastructure that expands communication and information-sharing among participating providers, hospitals, public health organizations, and other healthcare entities.

- **Massachusetts SHARE.** MA-SHARE is a regional collaborative initiative operated by the Massachusetts Health Data Consortium. With funding from various state entities, including several payors, the organization serves as facilitator of statewide initiatives. MA-SHARE supports projects that explore healthcare data connectivity to develop, pilot, and demonstrate new healthcare information technologies across communities and enterprises.

- **Nebraska Telehealth Network.** Working with the governor's office, a coalition of healthcare organizations has developed a broadband network to support telehealth capabilities (distance learning and clinician-to-clinician communication via videoconferencing). The network will support efforts to combat a potential bioterrorist attack or other public health crisis, and also will be valuable to improving overall quality of care across the state. Six of Nebraska's major hospitals are serving as hubs for the network, with smaller clinics benefiting from the reasonable cost structure. In addition, stakeholders are also moving forward on plans for electronic patient data exchange.

- **PeaceHealth.** PeaceHealth, an integrated delivery network in the Pacific Northwest, offers technology services and access to its comprehensive community health record (CHR) via an ASP/ISP model. Smaller, rural clinics and physicians that otherwise may not have the resources for significant IT investments can securely access the network for a modest market-based fee. Since the program began, 54 independent practices have signed on to use its EHR services, and more than a thousand authorized clinicians have full password access to PeaceHealth's CHR to support patient care. The CHR includes approximately 1.5 million patient records.

- **Taconic Health Information Network and Community (THINC).** THINC is a multi-stakeholder, community-wide data exchange among physicians, hospitals, reference laboratories, pharmacies, payors, employers, and consumers in the Hudson Valley region of New York State. It provides clinical, insurance, administrative, and demographic information for more than 600,000 patients via a secure Internet infrastructure incorporating standards for data exchange. Unique to THINC is the local, ongoing support provided by MedAllies, which provides training and support to community clinicians and their office staff members to drive adoption.

III. Best Practices Case Studies

A. HealthBridge: Collaboration, Not Boundaries

The initial impetus for a community health information network (CHIN) in greater Cincinnati did not come from healthcare providers, but from large employers in the area trying to control their healthcare costs. It was the mid-1990s, and across the country there were high expectations for what CHINs could accomplish. Unfortunately, at the time, there was not the critical mass of technology, culture, and political will to adequately support projects of that scope, and most of them never got off the ground.

But in the tri-state area around Cincinnati, the CHIN attempt had mobilized healthcare CIOs, and out of the ashes HealthBridge was born. It set an ambitious, but achievable, goal: to create a community-wide physician portal that would support the comprehensive delivery of clinical results across a 14-county area at the conjunction of Ohio, Kentucky, and Indiana.

In order to foster communication and trust among all of the stakeholders (including 18 of the 24 hospitals and two of the three major health plans), HealthBridge was set up as an independent 501(c)(3) organization. All stakeholders are represented on the board of directors.

HealthBridge At a Glance

Demographics
- 2.2 million population
- 14 county tri-state area (OH, KY, IN)
- 25 hospitals / $4 billion annual expenses
- 3 dominant private health plans
- Approximately 4,000 active physicians

Governance
- Independent nonprofit 501(c)(3) corporation
- All stakeholders (providers and payors) represented on governing board

Funding
- Seed money from stakeholders
- Self-sustaining from revenues for services provided

Technology
- Started with clinical message delivery
- Individual participants can overlay other applications

Challenges
- Foster collaboration while maintaining market competition among stakeholders
- Medical referral area covers parts of three states

The collaborative structure is one of the keys to HealthBridge's success. Because it relies on staying within the risk-reward comfort zone of major stakeholders, the progress may be too slow for some – but the resulting product has greater buy-in for the long-run.

In any such exercise, no one can force provider or payor organizations to participate; rather, they will do so only if there is a perceived benefit. The organizations involved have different levels of health IT implementation that must be accommodated, and there are multiple EHR vendors represented among the participating organizations. No single system is imposed on HealthBridge's members; for example, early adopters are not penalized by being forced to abandon their investment in favor of a different system or give up a competitive advantage.

From the outset, HealthBridge was intended to be self-sustaining. The board voted to forego grant funding entirely, getting seed money instead from five health systems and two health plans in the area. Healthcare organizations (hospital diagnostic facilities, labs, radiology centers, and

others) pay HealthBridge for the service of electronically delivering patient diagnostic test results to physicians, for whom access is free. Previously these organizations would have to use mail, fax, or telephone to communicate results to physicians, and electronic delivery is far more efficient and cost-effective. The potential return on investment from the results service was immediately understood by provider organizations when HealthBridge approached them about participation. Today, the results delivery service funds all of HealthBridge's other projects.

The cost savings to the provider organizations is substantial: St. Elizabeth Medical Center estimates that it saves an estimated $500,000 in hard costs per year by outsourcing delivery of diagnostic test results to HealthBridge, in addition to a 40 percent reduction in phone calls for reports. These savings benefit the medical center's bottom line and ultimately support improved patient care and patient service.

Clinical data, such as lab tests and other diagnostic results, are delivered to HealthBridge and consolidated into a single standard community interface. This password-protected portal is available online via the HealthBridge web site, which is accessible from any computer via a Web browser – enabling physicians to check the portal even when they are out of the office or overseas. Most physicians choose to access diagnostic test result information online, although they can also receive it via fax or hard copy mail if they prefer. Either way, there is only one location they need to consult to get data in a standard format from a wide variety of sources. Results are sent to the online portal every five minutes, appearing in the physician's "awaiting action inbox." Results can be sorted so that abnormal results are displayed first. If the provider has an EHR system, the results are delivered simultaneously to the inbox and to an HL7 file that is automatically uploaded into the patient's electronic health record. (The upload and related matching algorithms are provided by EHR vendors serving Cincinnati area healthcare providers, and process varies from vendor to vendor.)

Physician usage of the portal is high, currently running at about 46,000 logins per month. More than 1,200 physicians have opted to receive the information only online. This group represents the high-volume users, receiving an average of 700 results per month – about 10 times as many as those who prefer fax or hard copy mail.
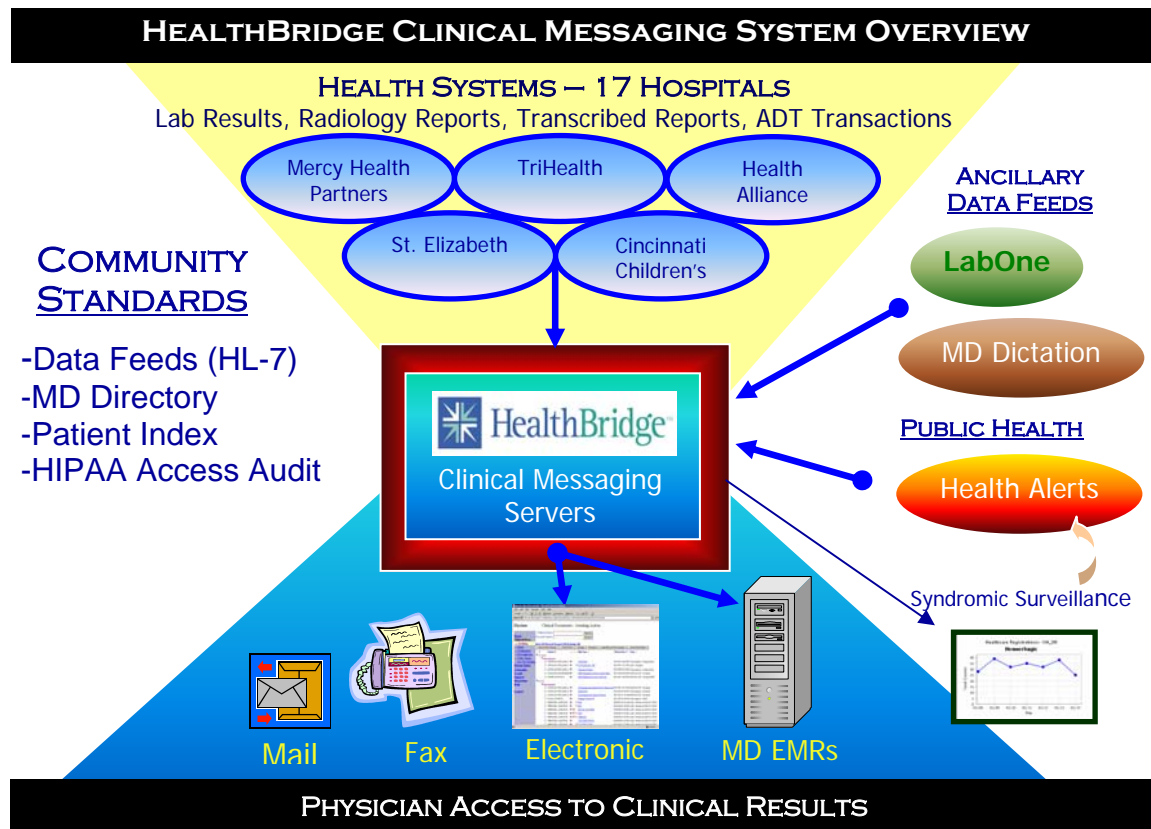
The standard interface makes it possible for HealthBridge to provide other applications online, as well. For example, it was relatively easy to develop an application that collects data about emergency department admissions and chief complaints and looks for patterns that could indicate the beginning of a disease outbreak. If such a pattern is detected, all participating physicians in the area are notified via the clinical inbox.

The biosurveillance example also demonstrates why RHIO participants need to think across political boundaries to take in the relevant medical referral area in a contiguous geographic region. People (and diseases) move freely throughout the tri-state area surrounding Cincinnati. Collecting *only* Ohio data would leave out a significant number of cases from the rest of the area, which could delay detection of an outbreak.

There are more than 50 available clinical applications through the HealthBridge portal, including record chart completion, fetal monitoring, radiology PACS, and ECG management systems.

HealthBridge rose to the challenge to improve healthcare quality by building a community resource that delivers true value for physicians. Individual stakeholders are free to overlay their own content, further enhancing the value of the system. This model succeeds because the independent organization represents the interests of all stakeholders, creating the trust that is necessary for such an undertaking. What makes HealthBridge unique is the opportunity it presents for collaboration and competition in equal measure.

Figure 1: HealthBridge Clinical Messaging System Overview

HEALTHBRIDGE CLINICAL MESSAGING SYSTEM OVERVIEW

HEALTH SYSTEMS – 17 HOSPITALS
Lab Results, Radiology Reports, Transcribed Reports, ADT Transactions

Mercy Health Partners • TriHealth • Health Alliance • St. Elizabeth • Cincinnati Children's

ANCILLARY DATA FEEDS

LabOne

MD Dictation

PUBLIC HEALTH

Health Alerts

Syndromic Surveillance

COMMUNITY STANDARDS

-Data Feeds (HL-7)
-MD Directory
-Patient Index
-HIPAA Access Audit

HealthBridge
Clinical Messaging Servers

Mail • Fax • Electronic • MD EMRs

PHYSICIAN ACCESS TO CLINICAL RESULTS

Conclusions

First and foremost, the founders of HealthBridge recognized that their biggest barrier was the human tendency to resist change. To overcome that barrier, they enlisted the following strategies:

- Create a trusted neutral organization that will foster collaboration among stakeholders;

- Provide a revenue-generating service that stakeholders will value (and pay for) to ensure a self-sustaining organization; consider a focus on patient results delivery, because of the benefits to healthcare quality and efficiency and immediately tangible return on investment for participants;

- Demonstrate potential return on investment and secure seed money from stakeholders, rather than grant sources. Requiring a substantial financial commitment from stakeholders defines the difference between agreement and commitment; and

- Do not try to move the organization faster than the risk-reward comfort zone of its stakeholders.

HealthBridge also recognized that people – and diseases – move freely across state lines, and the geographic scope of a regional health information exchange project needs to reflect this reality.

B. PeaceHealth: Managing the Health of an Entire Community

In the early 1990s, PeaceHealth set out to create a high-quality, safe, and effective system of delivering patient care that would operate seamlessly across its facilities in three states. Although the initial vision did not revolve around technology, it soon became apparent that a sophisticated infrastructure was necessary to connect PeaceHealth's six community hospitals and regional medical centers, as well as numerous outpatient medical groups, regional laboratories, and pharmacies. More importantly, the vision required creating not just a hospital-based record or a physician practice-based record, but a true community health record (CHR) that would encompass every location where care is delivered – including affiliated specialist practices and even the individual's home.

PeaceHealth serves medium-sized and rural communities in Alaska, Washington, and Oregon. A not-for-profit corporation with operating revenues of approximately $1.3 billion a year, it is relatively small, yet typical of the organizations that provide the majority of care across the country. PeaceHealth employs 340 physicians at its ambulatory clinics; medical staff members at the hospitals are predominantly from independent physician groups. The need to bridge both employed and independent physician practices fueled the CHR vision.

> **PeaceHealth At a Glance**
>
> **Demographics**
> - Population of more than 1 million citizens across three states (OR, WA, AK)
> - Primarily rural areas in three states
> - Six community hospitals and regional medical centers, plus numerous ambulatory clinics, labs and pharmacies
> - Operating revenues of $1.3 billion annually
> - 340 employed physicians
> - 1,700 independent physicians
>
> **Governance**
> - Integrated delivery network
>
> **Funding**
> - General operating revenues
>
> **Technology**
> - Comprehensive community health record (CHR) spanning both inpatient and outpatient environments
>
> **Challenges**
> - Extend CHR access to independent physician practices
> - Utilize the CHR to develop effective disease management programs for chronic illnesses

In less than 10 years since its first electronic record implementation, PeaceHealth has undergone a massive culture shift, moving from a non-automated environment to one that is almost completely paperless. Managing that culture change was by far a larger part of the process than the technology implementation itself. As other organizations have learned the hard way, imposing clinical IT as a fait accompli can, at best, limit the gains to be realized from the technology, and in a worst case scenario lead to a failed implementation. Instead, PeaceHealth involved its clinicians in revising existing workflows to adapt to the new technology, as well as in defining the metrics that would be used to measure quality and efficiency improvements.

Today at PeaceHealth's hospitals and clinics, nearly everything is available online, with the exception of physicians' daily progress notes and orders. Throughout the community, acceptance has been strong: fewer than half of the 16,000 authorized CHR users are PeaceHealth employees. The rest are primarily non-employed physicians and their office staffs that work in the regions served by PeaceHealth. Users can log onto the system securely from anywhere – hospital, office, or home – using a simple, yet secure, Web interface. As a result, clinicians are assured of access to complete, accurate, and real-time information about a patient – 24 hours a day.

Independent community physicians have recognized the value of having the CHR in their office settings to deliver care to all their patients, not just those treated at PeaceHealth. To serve this demand, PeaceHealth established a subsidiary known as EHI Works that leases CHR access at a "low but legal" rate to comply with federal Stark and Anti-kickback laws. This ASP/ISP model costs about $170 per physician per month for the full electronic record (including diagnostic images). Providers do not bear the expense of maintaining the software system. The only equipment required is a standard PC – which most practices already own. By comparison, a recent report in *Health Affairs* put the average cost *per physician* of acquiring a stand-alone system at approximately $33,000 per Full Time Equivalent in initial costs plus about $1,500 per provider per month to maintain. The exact per-physician cost varied inversely with the size of the practice.[6]

To complete the picture of enabling access to the CHR everywhere care is delivered, PeaceHealth has been piloting a patient portal, as well. The first phase provided primarily front-office functions, such as prescription refills and referrals, and has recently been expanded to permit access to individual patient charts.

The CHR has resulted in a wealth of clinical and operational improvements throughout the PeaceHealth system. Clinical improvements include:

- Adverse drug events have been reduced by 83 percent, as measured by a pilot study in PeaceHealth's 17-physician Barger Clinic (Eugene, Ore.);

- Allergy lists are close to 100 percent complete, thanks to an expert rule that flags missing information;

- Compliance with diabetic guidelines has tripled in three PeaceHealth facilities, thanks to a combination of disease management through CHR tools and involvement of diabetes educators;

- For diabetics, hemoglobin A1C levels (low levels indicate better blood sugar control) improved. Hemoglobin A1C levels of less than 7 (the target level for diabetes control) improved from 44 percent in 2001 to more than 60 percent last year; and

- LDL (Low density lipoproteins, a type of high-risk cholesterol) levels of less than 100 jumped from 28 percent in 2001 to 52 percent last year.

Some of PeaceHealth's operational improvements include:

- Patient cycle times in clinics have improved by about 20 percent, yielding greater medical group productivity;

- Nursing documentation time has been reduced by 50 percent in some inpatient units, giving nurses more time to spend on direct patient care;

- Surveys show that nurse and physician satisfaction with the CHR has increased significantly since the technology activation.

But perhaps the biggest impact the CHR has had is on analyzing outcomes data and managing population health. Data from the CHR is collected in a data warehouse, and from there it is sorted into separate data marts that are focused on specific chronic disease areas, such as diabetes, congestive heart failure, and community acquired pneumonia. Users can run detailed reports – drawing on two-and-a-half terabytes of clinical data – in a matter of seconds.

When Merck announced the Vioxx recall in September 2004, PeaceHealth was able to search its records for every individual for whom the drug had been prescribed, sort the list by clinic and physician, and in less than a day, notify each physician which of his or her patients were affected by the recall. To run such a report manually, searching through the records of 1.5 million patients would have taken weeks or months.

The ability to mine the data in this way becomes even more valuable when it comes to managing chronic diseases. About 70 percent of healthcare expenditures in the United States can be tracked to a relatively small number of illnesses, such as diabetes or cardiovascular disease.[7] Controlling these diseases, so that patients can maintain their health and prevent acute episodes, requires controlling the data. Using the CHR, it is possible to generate reports on specific indicators of health status such as cholesterol or hemoglobin A1c levels for diabetics. In addition to generating these reports on individual patients, PeaceHealth can review outcomes by region, clinic, or even individual physician.

Since the system first went live in 1996, PeaceHealth has collected electronic records for about 1.5 million individuals. What is remarkable about this figure is that it is about 50 percent higher than the total number of people who live in PeaceHealth's service area – and not all of those receive their care through PeaceHealth. This is a tangible reminder of how mobile our society has become, with people regularly moving from one region to another – and of the need for an electronic record that will follow consumers wherever they go. For now, PeaceHealth can deliver a lifetime electronic record only for those who stay within the Pacific Northwest.

PeaceHealth has given access to its data to Kaiser Permanente, a market rival. When asked why they would do this, John Haughom, M.D., Senior Vice President of Healthcare Improvement Division at PeaceHealth, replied simply, "Because it improves care." PeaceHealth knows that they will share some patients with Kaiser, and they want their medical information to follow them.

As far as PeaceHealth has come in creating its community health record, the organization still considers that it is at the beginning of a journey that will revolutionize healthcare. It characterizes the current record as "passive intervention," standardizing the way in which data is collected and stored so that providers can find it when they need it and use it to make informed treatment decisions. The next generation of EMR will be more active, with a greatly enhanced ability to mine the data to reveal trends, either across populations or to spot the early warning signs that an individual patient's condition is deteriorating. In the third generation, these capabilities will be applied to a patient's genomic data to yield interventions tailored to each individual.

In turn, the evolution of technology will lead to new models of care that are no longer encounter-based. The delivery of care can be more dispersed and proactive – and more individual-centered. The tools to make this happen are within reach. PeaceHealth demonstrates what can be achieved when an organization reaches out to embrace the technology and the massive cultural change required to realize the vision of seamlessly delivered, safe, and effective care.

Conclusions

Like HealthBridge, PeaceHealth approached its CHR as primarily a change management project with an IT component. Here are some other observations gleaned by PeaceHealth on the road to a 21st-century healthcare system:

- In order to provide individual-centered care, medical records cannot be limited to a single institution. They must encompass the entire community and beyond, as the U.S. population is increasingly mobile;

- To create a CHR, large provider organizations will need to assist independent physician practices to acquire the technology;

- Healthcare organizations must measure and demonstrate the value of data collected to providers (for example, by showing improvements in quality of care and time savings); once this occurs, demand for the system will significantly increase; and

- Electronic records not only improve the quality of individual care, they enable sophisticated population health management and outcomes research – but only if there is standardization in how data is collected and characterized.

C. CalRHIO: Building a Business Model for Health Information Exchange

With a population of 36 million people and an economy the size of mainland China's, California presents unique challenges to implementing a health information exchange (HIE). The sheer scope of uniting a fragmented delivery system that encompasses everything from rural clinics to some of the most prestigious healthcare institutions in the world makes the task a daunting one. Electronic records projects must compete for funding not only with acquisition of the latest diagnostic and treatment technologies, but also with completing critical seismic retrofitting before the next major earthquake.

As a result, in the very state that is home to the Silicon Valley – with its vast concentration of information technology developers – CalRHIO estimates that fewer than 10 percent of physician practices and 25 percent of hospitals are using electronic medical records.[8] Further, just 24 of California's 58 counties have HIE activities in progress.[9] As of mid-2005, 15 HIE organizations had been identified, with a third of them in the planning and funding stage and another quarter just beginning to get organized.

CalRHIO At a Glance

Demographics
- State population of 36 million
- Includes both large urban centers and remote rural communities
- Fewer than 10 percent of physicians and 25 percent of hospitals have functioning EMRs

Governance
- Independent 501 (c) (3) beginning in January 2006
- Initially incubated by The Health Technology Center

Funding
- $5 million over three years
- Combination of grant funding and commitments from provider and payer stakeholders

Challenges
- Catalog existing RHIO efforts
- Act as clearinghouse for best practices
- Support ongoing and new RHIO efforts

CalRHIO started in January 2005 as a project of The Health Technology Center to support – not supersede – RHIO efforts around the state. As an umbrella organization, CalRHIO's role is to lead a collaborative effort to:

- Incrementally build a statewide information exchange for California;

- Implement projects that build systems for data exchange, and demonstrate their feasibility and utility;

- Ensure participation by safety net providers and underserved populations in data exchange and IT investment;

- Build financial and business case models for health information exchange;

- Facilitate creation of common governance, process, technology, and other elements needed for regional and statewide data exchange organizations;

- Encourage business, healthcare, and policy leaders to create private and public policy agendas and funding for data exchange and IT investment;

- Help organizers of local and regional data exchange efforts within California work toward common goals and share what they develop and learn;

- Ensure that California's data exchange projects are consistent with national technology platforms and networks; and

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- Identify legislation and regulation necessary for statewide data sharing.

One project undertaken in its early months was an inventory of HIE projects in California. The object was to create an awareness of the various data exchange projects under way and provide a resource of information and contacts to both new and existing initiatives. By continually tracking efforts, CalRHIO and others will have a better understanding of the state of connectivity in California. The California HIE Inventory is available on CalRHIO's Web site and is updated quarterly.

Also available on the CalRHIO Web site are documents sharing what the organization has learned from setting up its own governance structure and business and financial models, such as options available for setting up an independent entity, sample bylaws and articles of incorporation, and options to consider in developing a sustainable business model for a RHIO. In addition, CalRHIO is developing a list of recommended standards for HIE that will be shared with providers throughout the state.

Further, CalRHIO also as a convener, bringing together providers, payors and other stakeholders in a neutral environment to talk about how to implement data exchange between institutions that may be competitors in the marketplace. Leaders from more than 60 health-related organizations, including health plans, hospitals, physicians groups, professional and trade associations, consumer groups, and federal, state, and county agencies are involved in CalRHIO Working Groups.

CalRHIO has selected five projects to work on, based on extensive conversations with stakeholders. The projects each have elements that will make it possible to eventually reach the goal of connecting California and ensuring that everyone in the state has a personal health record. Briefly, the projects are:

- **Emergency Department Linking:** This project will electronically link California's 359 hospital emergency departments, potentially using a statewide master patient index. Plans are to initially exchange lab and medication information, with additional data to be added in later phases. Currently, stakeholders are weighing in on the use case and requirements document, which will be used to develop a request for information, aimed at gathering technology solutions and associated costs. Pilot testing a solution is planned for early to mid-2006.

- **Infrastructure:** CalRHIO is in the process of exploring a statewide master patient index. Additionally, the project will support regional efforts for HIE and RHIO formation, define how stakeholders can connect and exchange information statewide, support EHR adoption, and connect to the national health information network.

- **Administrative Efficiencies:** The goal of this project is to improve connectivity and data exchange among business partners – hospitals, health plans, physician offices, registries, public health departments and extended care facilities. Specifics of the project are currently under development by CalRHIO's Business & Finance Working Group.

- **Medication Management:** Both Medicare and Medicaid require nursing homes to keep medication records for patients, but in the wake of Hurricane Katrina it is clear that the current systems for doing so are woefully inadequate. A pilot program is being considered to voluntarily promote wristbands, either bar coded or with RFID (radio frequency ID) tags for nursing home patients, which would link to personal health records for medication history by mid-2006.

- **Personal Health Records:** To give consumers more direct access to and control over their personal health information, CalRHIO is promoting the creation of a personal health record for every Californian. The Center for Health Transformation applauds this effort.

We advocate that this approach be taken at the national level so that every American has a personal health record by 2006.

Addressing privacy and security concerns is key if widespread adoption of RHIOs is to become a reality. Detailed written agreements that are both comprehensive and workable are required before any information exchange can take place. Because California's privacy laws are even stricter than HIPAA regulations, CalRHIO is studying these issues from both a technology and a legal standpoint. The organization is exploring the possibility of having a standard agreement that could be used by all entities throughout the state.

In the 10 months since it opened its doors, CalRHIO has achieved numerous milestones, including bringing together more than 140 stakeholders in work groups and statewide summits, conducting research and planning pilot projects, deciding on its future governance structure, creating an informational Web site, conducting successful fundraising, and responding to the federal Department of Health and Human Services' national request for proposals on privacy and security solutions and NHIN.

CalRHIO's complex organizational structure (*see Figure 2*) arose in order to address critical issues of governance and clinical priorities, and ensured that all stakeholder groups are involved in decision-making. The Planning Committee has acted as the organization's board, and the Steering Group, which includes people who are less involved in the day-to-day work of CalRHIO, has provided valuable viewpoints and feedback to the Committee. In early 2006 CalRHIO will become an independent 501(c)(3) organization with its own board of directors responsible for the organization's operations. It is anticipated that some of the current working groups will continue to function as project teams.

Figure 2: CalRHIO Governance Structure
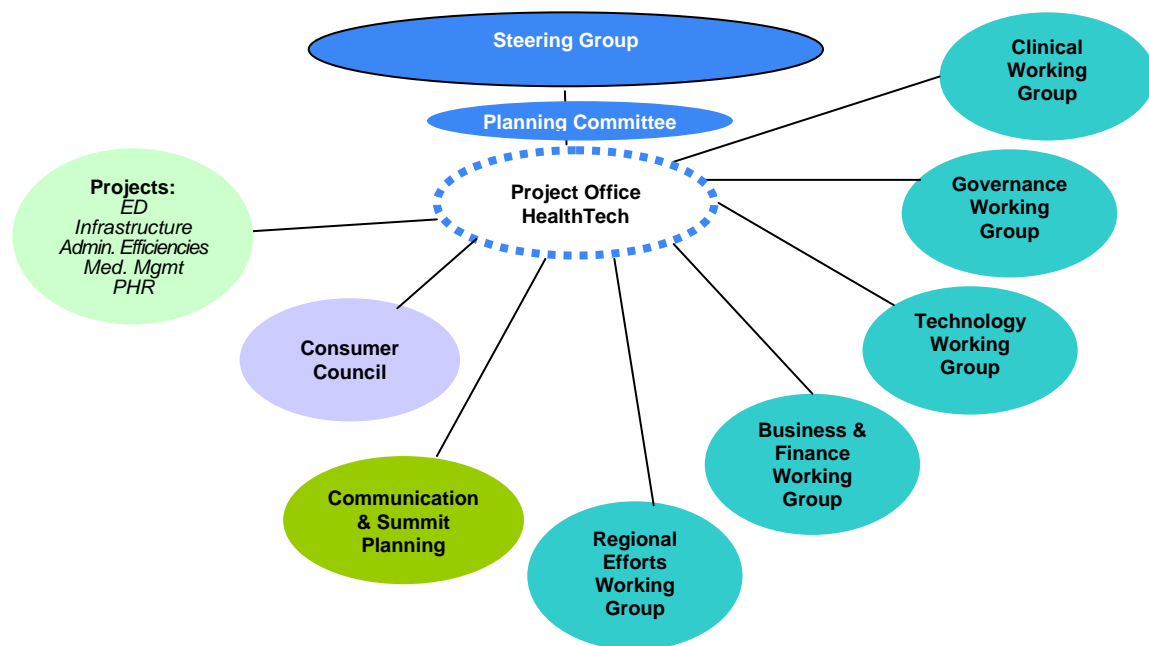
As of October 2005, CalRHIO has raised nearly $5 million in funding. Major support has come from the California HealthCare Foundation, Sutter Health, Kaiser Permanente, Blue Cross of California Foundation, Blue Shield of California Foundation, the University of California Office of the President, and Cedars-Sinai Health System. The Business & Finance Working Group is

currently exploring options for long-term sustainability of CalRHIO and will make recommendations to the new Board. Funding will continue to be separate from operational control.

While there is a tremendous amount of work yet to do before the vision of securely exchanging health data across the entire state becomes a reality, the mood in the Golden State is cautiously optimistic, even among those who participated in earlier efforts over the past decade or more. Near-ubiquitous broadband technology has replaced dial-up modems as the conduit for transmitting massive amounts of data. A wide range of wired and wireless devices make it more convenient to access text and images from almost anywhere. And a cultural shift in favor of sharing information has taken hold among providers, payors and government agencies – fueled in part by the need to move from an acute-care model of health care to one based on prevention, and underlined more starkly by the devastation of Hurricane Katrina. The momentum for RHIOs has reached critical mass.

Conclusions

Rather than running RHIO operations, CalRHIO has structured itself as an umbrella organization that provides leadership on statewide IT connectivity and investment in HIT and EHRs, as well as supporting existing health information exchange efforts and fostering the growth of new ones. Some observations drawn from CalRHIO's experience:

- Every RHIO is unique, facing different challenges based on its size and geography – therefore, there is no single "right answer" for how a RHIO should be structured;

- Nevertheless, RHIOs can benefit from the experience of other similar organizations, rather than having to reinvent the wheel when it comes to addressing issues such as privacy and security agreements, for example;

- Trusted leadership – someone who has a proven track record, is politically savvy, and is adept at bringing about consensus – is essential in bringing together physicians, hospitals, health plans, and other diverse stakeholders;

- Create transparency by using the Web to make meeting notes and other materials easily accessible to stakeholders and other interested parties;

- Develop a structure that creates enough hands-on opportunities (*e.g.*, working groups) for stakeholder involvement; and

- Welcome incremental change. Reforming the healthcare system is too big a transformation to occur in a single step. If we wait until everything is in place to start making changes, we will never get there.

D. Indiana Network for Patient Care: The Interface Between Technology and Policy

It has been more than three decades since Dr. Clement J. McDonald, a practicing physician and a professor of Medicine at the Indiana University School of Medicine, first envisioned a healthcare system that would eliminate the logistical problems of paper records, standardize the care process, and help to improve the health of populations. About 10 years ago, he was joined by Dr. J. Marc Overhage, now president and CEO of the Indiana Health Information Exchange. Working together at the Regenstrief Institute, the two colleagues created an operational community-wide patient record system known as the Indiana Network for Patient Care (INPC).

The first project INPC undertook was to demonstrate the feasibility and benefit of a community-wide electronic health record in patient care. The approach was incremental, starting by enabling information exchange among different institutions within a single healthcare system.

INPC At a Glance

Demographics
- Population of 1.5 million citizens (Indianapolis and surrounding communities)
- Referral center for entire state (7 million)
- Five major hospital systems (21 hospitals)

Governance
- Project of Indiana Health Information Exchange and the Regenstrief Institute
- Data-sharing agreement among participating healthcare provider organizations

Funding
- Combination of grants and service revenues

Technology
- Clinical messaging
- Data is captured and converted to HL7

Challenges
- Standardize data characterization
- Reconcile multiple patient and provider IDs
- Deliver clinical data services that add value for providers

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As physicians practicing in multiple hospitals in the Indianapolis area, McDonald and Overhage were well aware of the challenges involved in accessing complete, accurate data on the patients they were treating. Even within a single healthcare organization, information generally existed in separate silos – one for the lab system, one for radiology, one for the emergency department, and so on. The first step was to bridge those silos, both within and between institutions.

Specifically, they looked at data availability in emergency departments at three Marion County hospitals. (Marion County is the metropolitan county that is home to Indianapolis.) McDonald and Overhage chose an unlikely vehicle from today's perspective: paper. Viewed as a delivery method rather than a database, it had significant advantages over computers, especially in terms of physician adoption. They found that simply getting the appropriate data from one hospital to the emergency department at another saved $27 per ED visit.[10]

On the strength of this demonstration, Regenstrief received grants from the Agency for Healthcare Research and the National Library of Medicine to expand the INPC's reach. Today, 21 hospitals in five healthcare systems, local radiology centers, several national and regional laboratories, county and state public health departments, all four homeless care systems in the region, and about 35 percent of physician offices are part of INPC.

The architecture of INPC can be described as a federated consistent database. As a practical matter, healthcare institutions would not agree to participate if they had to relinquish the sizable investments they have already made in a wide variety of vendor information systems, so INPC

had to find a way to capture data from different sources, either batched or in real time, and then make it accessible across the system.

After receiving the data primarily as HL7 messages, the INPC standardizes the data. In the process, three things happen:

- INPC must determine what the data is. The use of different terminologies by different providers to represent the same bit of data is perhaps the biggest barrier to widespread data integration;

- INPC standardizes the format of clinical messages, using tools and procedures that work across the spectrum of providers and data sources;

- INPC works to reconcile the different identifiers for both patients and providers that exist across different healthcare organizations. As described by McDonald and colleagues writing in *Health Affairs*, the coded messages are mapped to a common code system (LOINC) to enable INPC staff to consolidate data about one patient from many institutions.[11]

In doing so, INPC has chosen to require a higher level of reliability in order to declare a match. The result is that, in some cases, patient information is incomplete, but this was determined to be preferable to inadvertently disclosing protected health information to the wrong individual.

The need to protect the privacy and security of health information underlies the INPC user agreement. Two years in the making, and vetted by more than 100 healthcare attorneys representing participating organizations, the agreement clearly lays out how participants can share health data for treatment purposes, who has access to what data for treatment purposes, and what information may be stored on the network. It delineates how information can be used for research or public health purposes. Finally, the agreement outlines a governance structure that gives participants a mechanism for meaningful input and oversight.

The amount of data contained in INPC's database is truly astronomical. Consider: 7 million registration events, 48 million orders, 45 million radiology images with 8.8 million radiology reports, and 25 million prescriptions. The system is accessed more than 3 million times per year for clinical care, and peak use has topped 10,000 accesses per hour. All INPC participants share the following information: ED and outpatient visits; hospital discharges and discharge summaries; inpatient and outpatient laboratory results; immunizations; operative notes; radiology and surgical pathology reports; inpatient medications; and tumor registry data.

Overhage notes that approximately 12 percent of physicians practicing in INPC's service area have an electronic health records system, and his estimation is that approximately one quarter of this small group are uploading patient data to their health record systems. Clearly, this is an area where INPC's value will continue to grow as more physicians gain access to EHRs.

INPC's vision is to use IT and shared clinical information to:

- Improve the quality, safety, and efficiency of health and healthcare in the state of Indiana;

- Create unparalleled research capabilities for health researchers;

- Exhibit a successful model of health information exchange for the rest of the country; and

- Facilitate the development and adoption of new health-related technologies.

In line with this vision, INPC is not merely about collecting data, but about providing services *using the data* that will add value for clinicians. The first was clinical messaging, which provided a more cost-effective means for labs, radiology centers, and other data sources to share information with providers. Other services include clinical abstracts, medication histories, and a master patient record that allows searching across multiple data sources for information about a single patient.

Providing and charging for these services is the basis for INPC's sustainability model, and the organization is close to reaching the break-even point. The Center for Information Technology Leadership economic model for health information exchange and interoperability (http://www.citl.org) estimates that central Indiana could achieve about $560 million in savings through greater efficiencies and improvements in care quality supported by automation. Capturing even one tenth of that amount would generate enough savings for INPC to be self-sustaining. [12]

Conclusions

For INPC the goal is not merely to collect data; the goal is to use data in a way that will add value for healthcare providers and contribute to higher quality care Clinical messaging provided the foundation for other services, demonstrating that:

- Starting with simple, achievable projects as proof of concept is a useful way to educate providers about the value these systems can deliver;

- Paper *can* have a role in healthcare – as a delivery vehicle, not as a database; and

- Projects such as INPC can pay for themselves by reducing costly inefficiencies.

E. The Nebraska Statewide Telehealth Network: Strong Partnerships Delivering A Statewide Health Information Infrastructure

The Nebraska Statewide Telehealth Network is an innovative public-private partnership that links nearly every Nebraska hospital to public health departments and state bioterrorism labs via a private digital network.

Built in just three years, the Telehealth Network reflects the combined efforts of a multidisciplinary group of clinicians, healthcare executives, business leaders and government officials. This group of 85 key players combined a collaborative approach with savvy awareness of technology's value in combating a public health crisis or bioterrorism incident.

As of fall of 2005, 95 percent of Telehealth Network connections are scheduled to be live by year's end. Rural hospitals will pay just $100 a month to access the network's videoconferencing capabilities. The initiative's next great challenge is to move from telehealth to establishing a full-fledged RHIO – the Nebraska Health Information Exchange. This effort will focus on patient data exchange, and computerized provider order entry in ambulatory settings (ACPOE). It is currently being determined how the network's infrastructure can be adapted and expanded to support this type of data exchange.

According to an October 2005 study for the Center for Information Technology Leadership (CITL), the combination of ACPOE and a standardized health information exchange, once fully implemented, could yield $4.8 billion in savings over an initial 10-year implementation process and a net value of $896 million per year annually thereafter.[13] The largest portion of value from a healthcare information exchange will accrue to payors and providers, according to CITL.

Nebraska's hospitals and physician practices will use the existing network in some of the following ways:

Nebraska Statewide Telehealth Network At a Glance

Demographics
- Population of 1.7 million citizens across 77,538 square miles
- 88 hospitals; 89 licensed clinics (includes public health clinics and other ambulatory facilities – does not include all physician practices)
- 60 of the state's hospitals are designated Critical Access

Governance
- State government maintains the network's technical infrastructure
- The network itself is owned by Nebraska's healthcare providers

Funding
- Public-private partnership
- Rural hospitals pay just $100 a month for network access

Technology
- Private electronic broadband network; T1 bandwidth for all hospitals

Challenges
- Establish a statewide telemedicine network (now nearly complete)
- Pursue patient data exchange and ambulatory CPOE

Available Now

- **Public health communications and "first responder" network:** Videoconferencing between healthcare providers, scientific experts and state officials during a bioterrorism incident, disease outbreak, or other public health crisis. The network is designed to support swift response from designated "first responders" in health crisis situations.

- **Patient care consultations and distance learning:** Videoconferencing to provide consultation on patient care between geographically dispersed healthcare providers (such as remote rural hospitals and tertiary care facilities located in metropolitan areas). Distance learning capabilities support medical education and continuing education for Nebraska's clinicians, especially valuable in a state where many physicians practice in isolated communities.

Future Opportunities to be Pursued

- **Secure electronic transmission of patient data:** As a private, secure infrastructure, the network has potential to be an appropriate and highly secure vehicle for transmitting patient data – such as diagnostic test results and diagnostic images. (Nebraska may also choose to develop a different technical infrastructure for this purpose.) This capability could enable far-flung rural healthcare providers to track their patients' care in real-time – a helpful tool when patients may be treated or hospitalized at facilities hundreds of miles from their homes. Many of the stakeholders involved in the Telehealth Network project are now working together on a Nebraska Health Information Infrastructure (NEHII) to support these goals.

- **Support broader adoption of EHRs:** Several of Nebraska's healthcare organizations have deployed EHR systems and are working towards interoperable communication between different vendors' technologies. Partner organizations are also examining options for making EHR capabilities and access affordable to smaller practices and clinics. Patients would benefit from more widespread use of electronic records, particularly in situations involving health emergencies and hospitalizations far from home.

Nebraska's health IT and telecommunications initiatives provide valuable lessons in how to build a sound foundation for a health information exchange. Some of the project's differentiators include a strong network of collaborative relationships, a well-planned technology infrastructure, and effective use of public and private funds. In describing the collaborative nature of the initiative, Lt. Governor Rick Sheehy said: "(This effort) takes more than T1 lines, firewalls, and routers. It takes leadership, vision, and collaboration."

Drawing on a Culture of Collaboration

The state's partnership-driven character and its efficiency and effectiveness as a national security hub are reflected in the Nebraska Telehealth Network's rapid growth. Both qualities are indicative of the state's culture and heritage. From early pioneers to later agricultural cooperatives, collaboration helped Nebraskans build a thriving farm economy in a harsh climate. Nebraska is also one of the nation's nerve centers for national security, as home to U.S. Strategic Command, which has a mission of providing global deterrence to combat adversary weapons of mass destruction worldwide.

To deliver care in a vast, rural state, Nebraska healthcare providers have long worked collaboratively, particularly when providing trauma care. In 1959, the Nebraska Psychiatric Institute at the University of Nebraska College of Medicine established the first functional telemedicine program in the United States.

In 1995, Nebraska's Good Samaritan Health Systems introduced the Mid-Nebraska Telehealth Network that became one of the most active networks of its kind in the nation.

By the late 1990s, healthcare organizations were eager to establish a statewide network, and the Nebraska Hospital Association also became a proponent for the effort. In response to this interest, the Nebraska State Information Technology commission, led by former Lt. Governor Dave Heineman (now Governor), formed a subcommittee on telehealth, helping the initiative gain additional traction.

Momentum for this effort grew further with several pivotal events in the new century. The events of September 11, 2001, combined with SARS outbreaks in Asia and Canada, raised national and worldwide awareness of the need for better communications and information resources in the event of a bioterrorism situation or other public health emergency. In 2004, President Bush called for more widespread use of EHRs within 10 years, further sparking the interest of Nebraska's medical community in health technology. In addition to pursuing the goal of a statewide Telehealth Network, stakeholders began to discuss opportunities to electronically exchange patient clinical data among providers, and also closely tracked the RHIOs forming in other regions of the country.

Network stakeholders continued to build support throughout the state's healthcare industry. Leadership of the Nebraska Medical Association and the Nebraska Phramacy Association joined the effort.

Identifying Barriers to Adoption

During this same time period, a telehealth feasibility study conducted by the Nebraska Center for Rural Health Research corroborated the fact that high technology costs were a significant barrier to introducing a statewide network. While some of Nebraska's major medical centers regularly achieve net operating margins of 5 or 6 percent or better, the state also has many small, geographically isolated facilities that face greater economic challenges – while benefiting from designation as Critical Access Hospitals.

Partnerships proved crucial to overcoming these funding barriers through an innovative public-private model. In addition, participants operated in a good faith effort to work together transparently and without hidden agendas – a quality that Telehealth Network participants emphasize as critical to the project's success thus far.

Establishing Public and Private Support and Funding

With momentum building across the state's healthcare community, stakeholders began to explore both private and public sector funding options for the network. One of the effort's chief evangelists was Admiral C.R. Bob Bell, Vice President for Business and Community Development at UNeMed Corporation. A for-profit subsidiary of the University of Nebraska Medical Center, UNeMed is instrumental in promoting technology and intellectual property developed at UNMC into the private marketplace. A former president and CEO of the Greater Omaha Chamber of Commerce, as well as a Navy Admiral, Bell was instrumental in bringing both government officials and business leaders into the Telehealth Network project and into the NEHII efforts.

Telehealth Network supporters also pursued public funding and participation. Supporters presented their plans to the Public Service Commission and testified before the Nebraska Unicameral Legislature to garner support and state funding. Bioterrorism funding was also dollars dedicated to the aspects of the program that focused on reaching first responders in the event of a health crisis. To date, the Telehealth Network has also received public funding, including federal Rural Utility Service grants and state bioterrorism prevention funding. Network leadership

envision that public funding will support the initiative during its first three to four years, with the initiative paying for itself as healthcare organizations benefit from cost savings.

In an innovative model, the Telehealth Network is owned by Nebraska's hospitals, but the technical maintenance and purchasing for the network is conducted by state personnel. The state government's significant purchasing power has been an asset in securing cost-effective contracts from the vendors supporting the Telehealth Network.

The Telehealth Network also is a public-private entity in terms of the organizations it serves. In addition to serving a mixture of private and public hospitals (including VA facilities), it encompasses the Nebraska State Bioterrorism Lab and Regional Bioterrorism Labs, as well as the State of Nebraska Capital and State Office Buildings. Today, Nebraska is uniquely prepared to manage real-time, face-to-face communications in the event of a statewide health emergency – an appropriate core competency, given the state's important role in national security.

As the Telehealth Network became a reality and interest in NEHII grew, network stakeholders garnered additional support throughout the state's healthcare industry. Leadership of the Nebraska Hospital Association, Nebraska Medical Association, and the Nebraska Pharmacy Association joined the NEHII effort.

Dr. Harris Frankel, a physician leader active in the Nebraska Medical Association, has been instrumental in founding and leading the association's Electronic Health Records Task force, which brings together 25 physicians, in addition to pharmacists, on a monthly basis to provide input into the Telehealth Network's development and help chart the state's future regarding interoperable EHRs. Involvement of the Medical Association helped ensure that physicians have provided ongoing input to the development of the telehealth network. Nationwide, only 15 percent of physicians are using EHRs and other forms of clinical information technology in their practices, and the Nebraska Medical Association is eager to help Nebraska outperform the rest of the country.

Seeing the potential value of a health information exchange to the quality and cost of patient care, Blue Cross and Blue Shield of Nebraska agreed to contribute start-up funding to NEHII. Describing his organization's decision to support the network, Steven S. Martin, President and CEO of Blue Cross and Blue Shield of Nebraska said: "Nebraska is uniquely ahead in its ability to deliver applications across the state. I have never seen a market with such a strong spirit of collaboration."

Thanks to a diverse base of public and private funding – from the state, Blue Cross and Blue Shield, and from larger participating hospitals – Nebraska is able to provide smaller, rural facilities with cost-effective telehealth access and is setting the foundation for broader health data exchange efforts.

Designing an Appropriate Technical Infrastructure

The Nebraska Statewide Telehealth Network operates over a private electronic network based on TCP/IP routed network protocols. The network is designed on a hub-and-spoke model, with eight major hospitals serving as hubs. All participating hospitals will access the network either through telephonic or fiber connections. The network will enable participating organizations to share patient lab data and other vital information, as well as to stream video, supporting live consultations between physicians. In a crisis situation, the networks' video capabilities would also support secure meetings between state officials and healthcare providers.

All Nebraska hospitals participating in the effort will have access to videoconferencing. The network cost-effectively purchased its videoconferencing equipment by consolidating its purchase with one vendor.

From a technical standpoint, the network is designed to be extremely secure, operating behind a firewall, with upgraded firewalls built for each of the hospitals participating in the network. Participating organizations recognize that safeguarding patient privacy will be one of the crucial considerations as Nebraska builds a patient data exchange. Both HIPAA regulations and Nebraska's own patient privacy regulations will serve as guides in ensuring the security of information. A fundamental operating principle of the Nebraska Telehealth Network and NEHII is that patients will own their personal data, and systems will need to be put in place to support patient permission.

Achieving Early Successes

During 2005, several events demonstrated the network's potential both to respond to crises and to transform patient care. During Hurricane Katrina, clinicians used the system to communicate with their peers across the state in response to the request for medical volunteers to travel to Louisiana. This ensured streamlined communications and a swift response, with approximately 100 clinicians volunteering.

The Telehealth Network was also invaluable in a patient care situation involving the tiniest baby ever born at Saint Elizabeth Regional Medical Center in Lincoln, Nebraska, a facility known for its outstanding neonatal intensive care. Born four months early and weighing just 13 ounces, the baby remained hospitalized at the medical center for four months. Through use of the Telehealth Network, the baby's hometown physicians, located a significant distance away, were able to consult with neonatologists at Saint Elizabeth. The baby's mother was able to more easily arrange support services for her family – and to communicate with family members. The enhanced communications capabilities available through the Telehealth Network made a world of difference for clinicians and family members alike. As a result, Saint Elizabeth medical staff will regularly hold videoconferences with families and doctors of infants with specific medical needs who reside outside the Lincoln area.

Developing a Healthcare Information Exchange

Healthcare throughout Nebraska is becoming more digital, with hospitals and health systems purchasing electronic health record systems, increasing use of medication dispensing systems, and using PACS to support overnight evaluation of digital images (such as CT scans). (Some Nebraska healthcare organizations are sending digital images to Australia for overnight evaluation by specialists, resulting in much faster turn-around of diagnoses and results.) All of these changes reflect an environment where healthcare information will be communicated in a more efficient fashion – 24x7 – supporting greater clinician efficiency, smoother coordination between healthcare providers, and profound improvements to quality of care.

Nebraska's healthcare community is eager to expand the Telehealth Network's capabilities as both a secure patient data exchange and as contributing technology for computerized physician order entry in the ambulatory setting. The strategy for establishing a data exchange will likely first focus on electronically transmitting Lab and Emergency Department data between providers. Providers in Nebraska – like their counterparts elsewhere in the United States – typically exchange information with five main stakeholders: independent laboratories and radiology centers, pharmacies, payors, and public health departments. As referenced above, CITL's report identifies tremendous cost savings based on replacing cumbersome phone, fax and mail-based processes with cost-effective electronic communication.[14]

The Telehealth Network could also potentially provide a springboard for more extensive ambulatory CPOE throughout the state – although this development would require more extensive EHR access within physician practices. CITL predicts, however, that medium and large offices would see positive financial returns within the second year of installed CPOE and data exchange, and that small offices and hospitals of all sizes would break even by year six. In addition, CITL predicts that use of CPOE could eliminate more than 13,400 outpatient adverse drug events (ADEs) annually, and prevent more than 8,000 outpatient visits and 1,200 hospitalizations due to ADEs. [15]

Personal Health Records for More Coordinated and Proactive Care

The ability to electronically pool and exchange patient data offers an opportunity to better understand health trends in Nebraska's overall population, and to support patients' informed management of their own care. For example, the NEHII may one day offer participating organizations the ability to compile anonymous patient data in order to track patterns in chronic disease outcomes – enabling providers to improve the care of patients with such conditions.

In addition to the development of a viable statewide healthcare information network, one of Nebraska's other innovations is a pioneering healthcare program known as SimplyWell, offering a combination of personal health records and disease prevention. Created by a team of physicians at the Nebraska Medical Center, Omaha, SimplyWell is founded on the principles of identifying healthcare risks and diseases, providing opportunities for individuals to improve their own health, and eliminating waste from the healthcare system. According to SimplyWell's president, Dr. James Canedy, "We wanted to move away from event management – how we've delivered care for the last 100 years – and move to a continuous relationship with the patient." Canedy cites the value of "replacing an ED visit with a doctors' office visit" – an informed patient is able to address health problems earlier before situations escalate and require a trip to the ED or hospitalization.

With user-friendly online tools, SimplyWell enables each patient to complete a comprehensive health assessment – which in turn creates a personal health record and health management program that the patient can securely access via the Internet from anywhere in the world. Each patient receives a customized action plan based on his or her health needs, access to more than 1,200 education modules and more than 16 comprehensive health guides. Patients within the online health management system receive reminders for preventive care, such as eye exams and annual physicals. Individuals can log their weight and other health indicators over time – and the system creates graphs and a medical record which can be shared with a physician. Additionally, a nurse call program and healthy lifestyle coaching add to the care continuum found within SimplyWell. With SimplyWell each patient becomes their own health manager, with resources to guide and assist their health improvement experience.

The experiences of Nebraska employers participating in the program show its potential. When one employer provided patients with a $500 credit to their Health Savings Account for participation in the program, they became 85 percent compliant. Another large employer saw healthcare claims costs decline by 67 percent when measured against regional norms. A university medical center measured a 33 percent difference between claims costs for employees participating in the program and those who were not. Longer-term participants in the program reduced their healthcare performance in such areas as high blood pressure, cholesterol, and hemoglobin A1C by an average of nine percent.[16]

As a personal health management program and health record, SimplyWell offers a complementary approach to the statewide initiatives to exchange patient data. Based on average claim reductions achieved to date, a 20 percent reduction in healthcare costs (including the cost of the program) could be within the realm of the SimplyWell approach to health management.

Conclusions

The development of the Nebraska Telehealth Network offers a number of best practices that are applicable to RHIO efforts around the nation. These include:

- Research current adoption levels of technology in your state or region and identify barriers to adoption;

- Make building partnerships the highest priority, and recruit evangelists to involve key groups such as government officials, payor organizations, and healthcare professional organizations;

- Pursue public-private financing opportunities;

- Know your short and long-term priorities for the technology;

- Invest in a thorough Value on Investment study for your proposed plans, in order to make long-term benefits as tangible as possible to participating organizations; and

- Promote the use of personal health records.

In the words of Admiral Bell: "Everyone knows this technology is going to work. The challenge is to execute – and to move from information as a means of control to information as a means of enlightenment."

IV. Potential Solutions to RHIO Barriers

During the CHT Connectivity Conference, attendees participated in facilitated discussions on many of the topics below. The following section combines insights and RHIO best practices from a variety of participants in the conference, as well as articulating the Center for Health Transformation's policy recommendations. Topics such as financing and privacy are complex and controversial, and this section is not meant to reflect the opinion of every participant in the conference.

A. Financing

Financing is critical to every business – local and regional healthcare networks are no different. RHIOs are multi-million dollar projects, and these investments must bring value to their communities, participating organizations, and perhaps most importantly, to the consumer.

The value of health information technology in general is not disputed. Whenever and wherever health IT has been implemented, the results are the same: it saves lives and saves money. The value of a National Health Information Network, which will be built upon RHIOs, is not disputed either. Study after study, most recently by RAND in *Health Affairs*, conclude that an interconnected system will save more than $80 billion a year. Such a system would also save thousands of lives every year by preventing medical errors and mistakes. [17]

But to bring this value to a community – and the nation – funding is needed. Short-term financing has been relatively easy to secure. There is grant money available from many sources, including government offices such as the Agency for Healthcare Research and Quality or the National Institutes of Health, as well as from universities and non-profit organizations. These funds have been a tremendous help to jump-start hundreds of exchanges nationwide.

Seed money has also come from many different private stakeholders in communities across the country. As noted, CalRHIO has received sizeable commitments from WellPoint, Inc., Sutter Health, Kaiser Permanente, as well as contributions from academic institutions and non-profit groups. As described previously, CareSpark is a RHIO in Tennessee that has received support from nearly 30 organizations, from Blue Cross and Blue Shield of Tennessee and Eastman Chemical Company to John Deere Health and East Tennessee State University.

Unfortunately, sustainable long-term financing remains elusive. The growth of RHIOs depends on broader adoption of electronic health records, and the average cost of an EHR to a hospital system involves a multi-million dollar investment. Costs are even more of a burden to individual physician providers, where start-up costs per physician when purchasing a group practice EHR can range from $33,000[18] to as high as $86,000.[19]

Federal government support is crucial to addressing financing challenges. The Center for Health Transformation recommends that the federal government should dedicate one percent of all discretionary spending, about $7 billion a year, to health information technology. As referenced previously in this report, according to the Institute of Medicine, nearly 100,000 Americans are killed every year by medical errors.[20] For this reason alone, the federal government should make the adoption of health IT on par with national security. The value has been demonstrated, and the need is obvious.

The sad reality is that the federal government has not expedited the widespread adoption of health IT, despite the fact that citizens are dying unnecessarily. This summer, Congress spent nearly $30 million in the highway bill for transportation projects at hospitals, from parking

structures and road resurfacing to lighting and access roads. However, this fall Congress refused to appropriate an additional $15 million that would have fully funded President Bush's request for Dr. Brailer's Office of the National Coordinator for Health IT.[21] What is more important: a smooth ride to the hospital, or an investment in health IT that may save your life once you are there?

The current budget scoring processes at the Congressional Budget Office and the Office of Management and Budget are at the heart of the problem. These institutions and their scoring models are barriers to meaningful federal leadership in health IT, healthcare innovation, and other critical priorities. The fundamental issue is that these institutions fail to distinguish between investment and cost. The current scoring models explain how much a piece of legislation would cost the federal government, but do not explain how it may be an investment by the federal government. Scores and projections must include an economic analysis of how a bill will impact the private sector, particularly when federal investment will save money in the end. For instance, federal spending that promotes health IT has the potential to save countless lives and billions of dollars every year in the private sector. But without scoring these benefits, the Congressional Budget Office and the Office of Management and Budget will never be able to distinguish between legislation as an investment and legislation as a cost.

In the absence of significant federal support, health information exchanges must find sustainable long-term financing elsewhere. One of the key features that RHIOs can leverage is the electronic data they will capture and generate. The ability to mine this electronic data and the wealth of knowledge that it will bring is the true promise of an interconnected network.

Every stakeholder can find value in this data. Researchers will have the opportunity to study aggregated clinical data, which will yield new breakthroughs in treatments, therapies, and understanding of disease. Hospitals and clinicians will have remarkable insights into analyzing and reporting patient safety issues, as well as outcomes for patient groups with similar conditions. Health plans will have the ability to better measure physician and hospital performance, valuable capabilities as the Centers for Medicare & Medicaid Services move towards outcomes-based, pay-for-performance models.

With improved access to data, consumers will be more knowledgeable about their own health and the performance of those who provide care. This kind of information will truly transform the practice of medicine – and it can be leveraged to finance health information exchanges. Both the Indiana Health Information Exchange in Indianapolis and HealthBridge in Cincinnati use this approach.

Hospital systems have certainly seen the value of health information exchanges, and have provided financial support in many communities. Physicians are beginning to participate as well. The Indiana Health Information Exchange has engaged 35 percent of all area outpatient physician offices. In Greater Cincinnati, nearly 4,000 physicians are singing the praises of HealthBridge for its ability to integrate electronic health record systems across the region. Other organizations, such as PeaceHealth in Bellevue, Washington, have introduced innovative subscription-based models to enable independent practices to subscribe to the hospital system's CHR.

Unfortunately, health plans have not been active participants in many efforts, though there is a clear value to their participation. There are pockets of health plan leadership, such as BlueCross and BlueShield of Nebraska and its financial support of the Nebraska Health Information Exchange, and BlueCross and BlueShield of Massachusetts' work with the MA-SHARE initiative.

Some RHIOs have chosen not to leverage data for financing, and have found other revenue streams. They could use direct pay-for-use models where participants pay according to the value they receive from the RHIO, whether through fees negotiated upfront, a metrics-based fee

schedule, or monthly dues. Billing and transcription companies also could be charged access fees. Other models see consumers as the ultimate source of payment for these efforts.

Whatever the approach, costs must be shared by all participating stakeholders. If the value of a RHIO is demonstrated to its community, the market will ensure its financial viability.

B. Health Management

In September 2005, the call for computerized medical records to manage population health shifted from industry-wide focus to mainstream attention. After Hurricane Katrina left thousands in Louisiana without access to their prescription drug information, test results, and allergy records, the importance of electronic personal health records was heralded across the United States, capturing headlines from the *San Francisco Chronicle* to *The Washington Post*. "With Katrina, we saw data needed to be available within one day – not ten days," said Newt Gingrich.

Hurricane Katrina was not the first widespread public disaster to underscore the deficit in electronic health records. During the outbreak of Severe Acute Respiratory Syndrome (SARS) in 2003, the city of Hong Kong was forced to rely on police data systems to track the deadly disease because it lacked a central data repository for its citizens' health records. Combine a city with 7.5 million people packed into just 35 square miles with a highly infectious disease spread by close person-to-person contact, and the result was devastating. Nearly 300 people died from SARS in Hong Kong alone – accounting for nearly 40 percent of the worldwide SARS death toll. Travel to the area plummeted, and those who lived in Hong Kong kept to their homes for fear of contracting the disease, creating a severe strain on an economy almost entirely dependent on the service sector. The consequences of not being able to monitor and respond to an avian flu pandemic would be even more damaging, especially in the United States.

But extreme disasters such as hurricanes and infectious outbreaks are not the only reason the need for EHRs is so pressing. Chronic diseases, such as heart disease, cancer, and diabetes, are the leading causes of death and disability in the United States, accounting for 7 out of 10 deaths and affecting 90 million Americans.[22] What's more, chronic disease is costly. The annual expenditure for healthcare and lost productivity from congenital heart disease, for example, is estimated to be $23.2 billion.[23] Organizations such as PeaceHealth and Park Nicollet Health Services (St. Louis Park, Minn.) are leading the way to improved population health management through the use of electronic health records systems. While Park Nicollet is using its EHR as a rich source of data for evidence-based practice, PeaceHealth's community health record helps manage the health of more than a million patients across three states.

Data Not Simply for Data's Sake

To truly manage health, it is crucial for an organization or region not only to collect data, but also to know *what to do* with the information it is collecting. "A health information exchange has no value if you don't do something with the data," said J. Marc Overhage, M.D., Ph.D., President and CEO for the Indiana Health Information Exchange.

The PeaceHealth CHR pulls data from the organization's clinical information system, imaging system, and various ancillary systems and stores that information in a data warehouse, which in turn populates various data marts designed to drill down to specific areas of focus, such as practice management, financial, or chronic diseases like diabetes and congestive heart failure. PeaceHealth's ultimate objective for creating its data warehouse was to extensively measure, then drive clinical improvement programs.

PeaceHealth clinicians, regional medical groups, independent physicians, and various other stakeholders leverage the CHR and its easily accessible data analysis in numerous ways to improve the quality of care for individuals in the community. Mining the data in approximately 1.5 million charts to determine cholesterol levels for diabetic patients takes minutes, not weeks or months. With the ability to control health data, PeaceHealth has seen a three-fold increase in adherence to guidelines for diabetic care among patients in three of its facilities. As a result, PeaceHealth's board of directors now spends much of its time reviewing clinical quality and

safety reports to improve the care and safety of its patients, rather than reviewing financial reports.

Proactive health management involves more than data management and analysis. "If you really want to manage health, you must have both the data warehouse for retrospective data analysis as well as [concurrent data] for real-time support [of patient care]," cautioned Dr. John Haughom of PeaceHealth. "Expert rules, online guidelines, and computerized physician order entry (CPOE) are essential ingredients."

This data can also dramatically improve patient safety, and this must be a core principle of every RHIO. Measuring, monitoring, and analyzing processes within facilities and across communities will allow RHIOs to capture data and use it to improve the delivery of healthcare. This technology must be embedded in the foundation of RHIOs from the beginning because at their most base level, RHIOs are about saving lives and improving care.

New Models for Care Delivery: Involving Patients and Their Families

Patients and their families are critical stakeholders in the management of their own health – a seemingly obvious assertion, though these individuals are rarely considered part of the care team. "The largest untapped healthcare resource in this country is patients and their families," Haughom said. "If we're really going to manage chronic disease, as the baby boomers age, we're going to have to engage patients and their families."

Enabling and encouraging patients and their families to manage their own health requires empowerment – providing people with technology tools to understand and make decisions about their care. Studies have shown that empowering patients dramatically improves quality and safety of care, ultimately reducing the costs of unnecessary emergency department visits and hospitalizations.

PeaceHealth has created a shared-care plan, a Web-based tool that serves as the patient's personal health record that can be populated by the doctor, nurse, patient, and family. The personal health record is different from the files the physician's office maintains, in that it may include information provided directly by the patient, such as daily food intake, exercise activity, or supplemental vitamin logs. PeaceHealth has found that patients enjoy playing an active role in maintaining their own records, and it has proven to be very effective. "Patients and their families really do get engaged," Haughom said. "They track whether they've had their flu shots or whether they've stayed current on necessary blood tests."

To be successful, patient-centered technology needs to seamlessly integrate into the workflow of individuals' lives. "Just as introducing technology into the healthcare organization requires seamless integration into clinician workflow in order to be accepted and successful, individual involvement in managing personal health needs to fit into the patient's lifestyle," said Michael Raymer, Senior Vice President and General Manager, Carecast Operating Unit, IDX Systems Corporation.

With this in mind, several companies are working to create technology solutions geared around individuals' lifestyles, while providing mechanisms for active communication and collaboration with physicians, nurses, and pharmacists. For example, HealthPia, a Korean-owned communications company, has developed a cell phone that includes a tester for diabetics. Users can place a drop of blood on a strip, place the strip in a special reader on the phone, and obtain insulin and blood readings on the phone display. Readings can then be uploaded to an online database for retrieval by the patient's caregiver. Another company has created weight scales to transmit readings from a congestive heart failure patient's home to a healthcare facility. Scales digitally record the individual's weight and body mass index, and the answers to a series of yes or

no prompt-detection questions (such as, "Are you experiencing shortness of breath?") help alert the care provider to critical symptoms before they become acute enough to require a visit to the emergency department.

Consumer-centered technology has aided medication reconciliation as well. Many physicians now receive fill/refill reports to track patients who have not fulfilled their prescriptions. At many organizations, patients who have not filled their prescriptions within a given timeframe receive email reminders until the prescriptions are filled, playing a huge role in compliance.

Pay for Performance

Technology is reshaping the model of healthcare delivery. The end goal is to move away from an encounter-based system of care to a proactive system of care. This model needs to focus on outcomes, with empowered physicians who are paid to keep individuals from becoming patients. In other words, physicians should be reimbursed for keeping the people in their communities healthy and out of the hospital, not for how many patients they see or procedures they perform. Currently, the Centers for Medicare and Medicaid Services is piloting a pay for performance program with ten major physician group practices around the nation, which will provide a financial initiative for physician groups that improve patient outcomes, based on progress with specific disease conditions, such as congestive heart failure and diabetes. In addition, the Leapfrog Group, a national coalition of major employers, is recognizing hospitals for performance on patient safety criteria (supported by technology adoption), with member organizations pledging to contract with high-performing organizations.

In the future, a 21st Century Intelligent Health System will allow an individual physician with a team of three to five nurses or other allied healthcare professionals to leverage health information technology and its data to manage 10,000 patients – instead of the 2,000 they manage today. Physicians will spend their direct time with two to four percent of their patients, relying on the rest of their care team to manage patients with minor afflictions such as colds or the flu. This team will be rewarded for the quality of care it delivers, not the quantity of care.

The payment structure must be a key part of a complete system transformation. "If we are trying to promote wellness, we need to stop rewarding sickness," said James Edlund, M.D., medical director of informatics for Parkview Health in Fort Wayne, Indiana. "We need to incent physicians above and beyond for outcomes."

C. Privacy and Security

Health information exchanges must make privacy and security a top priority. If consumers are not convinced that their personal health information is secure, if patient privacy is not adequately protected, any RHIO or health information technology is doomed to fail.

At the same time, when consumers are satisfied that confidentiality is adequately safeguarded, the benefits of health IT greatly outweigh the costs. A sample of recent news headlines shows the dichotomy. First, the bad news:

- **Ohio system says error made patient data available** (*Modern Healthcare's Daily Dose*, November 4, 2005)

- **Brailer's IT plans draw fire: Privacy, RHIO concerns surface as contracts awarded** (*Modern Healthcare*, October 17, 2005)

- **Is your claim information safe?** (*Claims Magazine*, September 2005)

- **Joplin hospital reporting some records stolen** (*Associated Press*, July 25, 2005)

- **Medical firm's files with personal data stolen** (*Arizona Republic*, July 13, 2005)

- **Privacy breach costs Kaiser:** $200,000 fine for leaving patient information on public web site (*San Jose Mercury News*, June 21, 2005)

Now, the good news:

- **IBM to put genetic data of workers off limits** (*The New York Times*, October 10, 2005)

- **'Big brother' devices provide nonintrusive care for the elderly** (*Saint Paul Pioneer Press*, October 5, 2005)

- **Poll: Data security is top concern of healthcare IT pros** (*Medical Devices & Surgical Technology Week*, September 4, 2005)

- **Majority of consumers believe electronic medical records can improve medical care** (*Business Wire*, July 20, 2005)

- **Consumers support EMR adoption but privacy concerns remain** (*Modern Physician*, July 2005)

We have seen this dichotomy in action before. Consumers have become comfortable with technology in other areas of their lives, such as online shopping and Internet banking, and recent studies show that they can have faith in and will be eager to use health IT as well, as described in much of the media coverage above.

Personal health records are an important step to engage consumers in their care. A recent survey by the Markle Foundation showed that nearly seven out of 10 respondents would use an online personal health record to check for mistakes in their medical records, and to check and refill prescriptions. Nearly six in 10 respondents said they would like to get medical results over the Internet, and more than half of all respondents would use a personal health record to exchange secure and private emails with their doctors.[24]

Balance these results with those from another Markle Foundation survey, and we can see that the enthusiasm for using health IT is tempered by fears surrounding privacy, security, and confidentiality. According to this study, 81 percent of respondents rate the ability to review which clinicians or other individuals have accessed their personal health information as a "top" or "high"

priority. Seventy-nine percent of respondents say it is a "top" or "high" priority that their medical information be shared electronically only with their permission. And 91 percent of respondents say that preventing unauthorized access or cases of mistaken identity by carefully confirming the identity of anyone using the system is a "top" or "high" priority.[25] This is the context in which health information exchanges must operate, and they must be designed with these priorities in mind.

The debate will continue over "who owns the data?" At the very least, health information exchanges can allow consumers the ability to access their health information, as well as control over who else has access to it. Some stakeholders may argue that even this goes too far in empowering the consumer, but RHIOs – and ultimately the National Health Information Network itself – should be built to improve consumer health, not to protect the status quo of proprietary interests. Giving consumers more say in their healthcare and direction over how their information is shared is an important part of the equation.

A uniform way to properly identify patients and their health information is also crucial. Options vary from a national patient identifier, akin to a healthcare Social Security number, to a master patient index or a record locator service. A national identifier is a more accurate, efficient, and cost-effective approach because it minimizes the technical contortions and architectural difficulties that are necessary to implement a community-wide, or more formidably, a nationwide, record locator service. But politically it has been and will be very difficult to achieve.

A national identifier could be made palatable to privacy advocates by making such a system voluntary. An opt-in national identifier system gives citizens a choice between protecting their privacy at all costs and improving their health and healthcare. If consumers knew that an accurate, real-time digital health record based on their own unique personal identifier would improve their health and possibly save their lives, the vast majority would choose its convenience, accuracy, and improved outcomes over privacy concerns, particularly if those concerns can be addressed with effective technology safeguards. There are those citizens who still refuse to keep their money in banks or use credit cards due to privacy concerns. These individuals could choose to maintain paper health records – despite the fact that such records are more likely subject to theft and duplication and lead to worse outcomes than electronic records.

Another solution for reaching the correct individual health information is a record locator service. The Massachusetts Health Data Consortium, through its MA-SHARE initiative, created a record locator service that accesses different databases to identify all the interactions a patient has had within the network. The index itself does not contain any clinical information, only technical directions to locations on the network that do. Consumer consent is required for data to be housed in the service, ensuring that the consumer controls what information is contained there and who can access it.

Designs will differ from one RHIO to the next. Results and successes will drive which approaches are the most attractive for others to duplicate. But one vital feature that all exchanges must have is ensuring that the right patient's information is pulled at the right time. By ensuring accurate data both clinicians and patients will have confidence in the RHIO.

As health information exchanges proliferate, consumers need to be assured that their records will be adequately protected, whether they are in San Francisco or Miami or Houston. Because information technology extends healthcare across state borders – consider HealthBridge, serving 2.2 million residents of 14 counties in three different states – the federal government must play a role in safeguarding electronic health records. Inconsistent from state to state, today's patchwork of privacy and security regulations only hinders the creation of a national health information infrastructure. Therefore, Congress should consider passing legislation that explicitly preempts state privacy and security laws to create a common regulatory framework for health information

technology that includes consistent privacy safeguards. The Department of Health and Human Services awarded a $10 million contract this fall that will examine the disparate laws and regulations and make recommendations on harmonization. Rep. Nancy Johnson (R-CT) introduced a bill this fall that lays out a roadmap to create a uniform regulatory framework while ensuring the privacy and security of personal health information. Both of these efforts are vital to expedite adoption of health IT and to build the National Health Information Network.

At the same time, the penalties for the malicious use of personal health information must be significantly enhanced. Hacking into electronic medical files should be a federal crime that carries harsh punishments, with prison sentences and steep fines per incident or per file. Congress must adequately fund enforcement of these laws, and hold the responsible agency (be it the Department of Health and Human Services, Office for Civil Rights, or the Department of Justice) accountable for swift and aggressive action against those who make unauthorized use of the information. Additionally, Congress should make publishing or posting online any personal health information a federal crime. This is a clear invasion of privacy and could be defamation. Demonstrating to consumers that penalties will be deterrents to privacy and security breaches and that criminals will not get away with a slap on the wrist will go a long way to convincing them that their personal health information is secure.

Creating a uniform regulatory framework does not have to mean that privacy laws must be reduced to the lowest common denominator. Laws could certainly be strengthened to achieve uniformity. If Congress does not have the political will to tackle this vital issue, at the very least the National Conference of Commissioners on Uniform State Laws should create model legislation that all states should pass unchanged to harmonize their privacy and security. Our legal code should reflect today's realities. If it does not, it restrains progress.

D. Technical Infrastructure

The potential benefits of RHIOs and other types of health data exchanges are widely acknowledged throughout the healthcare industry. Addressing the issues of interoperability and technical infrastructure are crucial to achieving the greater gains of more informed clinicians, healthier patients, and more efficient, high quality and cost-effective care. While disparate healthcare organizations – often competitors – face challenges in collaborating, the industry must build bridges between disparate EHR software systems, and advance solid and secure structures for patient data exchange.

Two Successful Interoperability Models in Action

The experiences of PeaceHealth and the Indiana Network for Patient Care illustrate two successful RHIO models. PeaceHealth represents a more homogeneous approach. PeaceHealth is the dominant player in its service areas, encompassing communities in three separate states, Oregon, Washington and Alaska. As noted previously in this report, the organization maintains a community health record (CHR) that serves more than a million patients, and that also includes data provided by competing organizations and by independent practices. Building the record on a single EHR solution has helped simplify many of the interoperability issues inherent in exchanging patient data. In addition, PeaceHealth successfully populates its CHR with data received from independent practices and competing organizations. Not only does the CHR support ongoing clinical care, it also provides a rich resource for data analysis, enabling PeaceHealth leadership to assess the organization's ongoing performance in treating various chronic disease conditions. (A case study on the PeaceHealth model is provided in section III-B.)

Through the Indiana Network for Patient Care, five major healthcare organizations in Central Indiana provide emergency department inpatient and ambulatory clinicians with immediate access to comprehensive electronic patient data. The information exchange has also introduced community-wide clinical messaging, offering nearly 3,000 physicians a single, electronic source for clinical results (such as diagnostic test results and data from patients' ED and hospital visits). (See section III-D for more information.)

Hospitals participating in the network use numerous EHR systems from competing vendors. The non-profit research organization Regenstrief Institute serves as a neutral third-party clearinghouse and information broker for the organization.

Each vendor system sends patient data to the INPC. As described by Dr. Clement McDonald and colleagues in the journal *Health Affairs,* Regenstrief fully standardizes the messages, maps local observation and report codes to a universal standard, and links multiple patient and physician identifiers for one individual to a standard ID.[26]

While PeaceHealth reflects a more homogeneous model and INPC a more heterogeneous one, both organizations are successfully addressing the complex technical requirements of patient data exchange. However, diverse healthcare organizations using diverse vendor systems must surmount numerous challenges in order to exchange patient data. The majority of RHIOs in the United States are likely to be heterogeneous models, bringing together healthcare organizations that use different vendors' EHR systems. Some of these key challenges are outlined below, along with recommendations for positive first steps that the industry can take to promote interoperability and the growth of data exchanges.

Challenge: Non-Standard Identifiers

Each organization and each vendor system records contact information for physicians in a different way. It's not atypical for there to be different ways that a particular physician is coded, varying from software system to software system, even within the same hospital or healthcare system. Regenstrief Institute, for example, maps all the varying identifiers for each physician into a new standard identifier – enabling physicians to receive electronically transmitted patient results.

The HIPAA National Provider Identifier (NPI), effective May 23, 2007 but available now, will assist to provide a single, standardized approach for provider coding. Organizations should prepare for the availability of the NPI by migrating all of their systems to a common identifier and adding fields for the NPI to their medical staff database systems. As a stopgap, organizations that are successfully standardizing provider identifiers may wish to share or market their expertise so that other organizations can better reconcile different codes prior to the HIPAA deadline.

As noted previously, the nation lacks a standard patient identifier. The lack of patient identifiers also presents costly difficulties for local patient data exchange efforts, and for making the leap to national health information exchanges. But to date, the political culture of the United States has not been amenable to a standard or national identifier. Current appropriations language prohibits the Centers for Medicare & Medicaid Services from expending funds to create a national patient identifier. Additionally, Connecting for Health, a public private collaborative sponsored by the Markle Foundation, points out that creating a patient identifier would require years of work and upgrading of nearly every health IT system in the country.

The reality is that most existing healthcare EHR systems already create patient identifiers, but these are "opaque" and known only to the healthcare organization maintaining the identifier. Clearly, the issue of patient identifiers has not been framed in terms of the patient safety benefits, especially given an increasingly mobile population. However, patient privacy safeguards are a crucial prerequisite for any use of a voluntary patient identifier program. This issue needs to be revisited, in combination with privacy legislation with teeth to ensure that patient data is well-safeguarded from improper use.

Challenge: Clinical Data Components and Messaging Standards

There are numerous specialty-based standards bodies that manage technical coding for specialty areas, such as laboratory test results, clinical terminology, and billing and procedure codes. This environment has led to overlap, siloing, and competition between standards organizations. Within the past two years, both ASTM International and HL7 introduced competing standards for patient continuity of care records, although both organizations are now collaborating to create a common solution. Furthermore, vendors do not universally use and embed existing standards in their products, and healthcare organizations do not require effective support of standards as a prerequisite when selecting or implementing a software system.

For example, the Indiana Network for Patient Care describes how it regularly receives HL7-based reports from vendors where all the necessary data elements are crowded into a single field, rather than assigned to appropriate categories (for example, the patient's medication dosage and the provider's street address are mixed together in a single field.)

Convergence upon a single set of data standards for interoperability is needed for several reasons. First, competing standards pose a significant technological barrier to the development of an interoperable EHR, and discourage vendors from incorporating standards into their electronic health record systems. Secondly, any further delay or a dual-standard approach will give the federal government the justification it needs to step in and mandate a set of standards. No one in

the industry favors that approach. Thus convergence and consensus should be driven by the private sector, and it must be immediate. Without this we will never progress in building an interoperable National Health Information Network.

Health IT, particularly EHRs and health information exchanges, needs a universal, single set of data standards for interoperability.

This fall the Department of Health and Human Services awarded a contract that established the Health Information Technology Standards panel, which will harmonize the major health IT standards across the industry. However, aggressive timelines are required to resolve standards issues in a timely fashion. It is widely recognized that a minimum set of standards should first be approved, with future elaborations that extend to enable fully interoperable electronic clinical information. Since patients' lives could ultimately depend on clean, accurate data, improving the quality of coding is definitely worthy of public and industry investment.

In addition, vendors of EHR software must ensure that their systems are built on a service-oriented architecture. A service-oriented architecture enables data to be exchanged with other information systems via Web services, which transmit specific pieces of data between systems without requiring costly interfaces.

Overall, the following actions are recommended to support greater interoperability and build infrastructure across the industry:

- Standards development organizations should work with the healthcare community to create implementation guides and use cases for all standards;

- The industry needs immediate convergence and consensus upon interoperability data standards that are endorsed and approved by all stakeholders, including standards-developing organizations, vendors, and specialty societies;

- Organizations currently exchanging electronic data need to measure the value of their work in order to create value propositions to increase industry support and investment;

- Large vendors should commit to building products that incorporate a standard, service-oriented architecture. This approach uses Web services to support faster, simpler, and highly secure communication of data elements between existing software systems. It is vital for different software systems to be able to effectively exchange data, and that vendors and healthcare organizations alike work together in a collaborative fashion;

- Regional organizations should consider first implementing a mechanism to communicate patient results to providers and support regional emergency department care with electronic patient data. With these capabilities in place, data exchanges and RHIOs are then better positioned to pursue labor-intensive projects such as electronic prescribing and CPOE; and

- Organizations embarking on RHIOs should create a neutral party, such as a 501(c)(3) organization, that can address standards challenges and data reconciliation across participating organizations. Both the donor community and the federal government should consider the funding of such organizations a high priority.

In the words of J. Marc Overhage, the interoperability challenge is not a case of trying to "boil the ocean." Rather, the healthcare industry should pursue actionable steps that can bring greater order to an environment of divergent and competing data standards.

E. Cultural Change

In 1919, the American College of Surgeons developed a landmark series of requirements for hospitals, stating that "they could only guarantee high-quality surgical care by setting minimal standards for the hospitals in which their surgeons worked."[27] The core criteria included "the presence of a complete, accessible, and accurate record for all patients, which had to be kept by the hospital, rather than the individual physician."[28]

At the time, requiring hospitals to maintain and make patient records available to other caregivers, rather than make do with physicians' traditional practice of jotting down notes in private notebooks kept for individual research, was akin to a medical revolution.

Predictably, initial reaction from the physician community was poor. Many physicians who did not readily see the value of an individual-centered record of care, and were accustomed to following their own care practices, "complained about the proliferation of pre-formatted forms, in which they only had to fill in a few words or even just select a term from a pregiven list."[29]

Sound familiar?

Change is never easy. It is always disruptive. It replaces existing paradigms and creates uncertainty. But the level of difficulty should not dissuade us from progress. If that were the case, we would never have entered the industrial age in the 19th century, or landed on the moon, or created the interstate highway system.

If you look at the typical office visit with a physician, it doesn't differ fundamentally from the typical office visit a generation ago. We must have in healthcare the same level of technological advancement that we embrace in all other sectors of society. But getting there will upset comfortable routines. It will force entrenched stakeholders to change. And yet it is absolutely necessary because in the end it will indeed save lives and save money.

Whether the goal is to share patient records with a specialist down the street or across the country, initiatives that dramatically change the landscape of accepted practice will initially meet with some cultural resistance. However, careful planning and well-executed change management strategies can turn resistance into enthusiasm. The American College of Surgeons' then-radical suggestion to create formal medical records represents the standard of care today. Likewise, consumer-centric electronic records that are available anywhere, to appropriate caregivers, will be the standard of care for tomorrow.

To reach that point, healthcare leaders must be cognizant of the cultural challenges inherent in building regional and nationwide networks of health information – as well as the range of stakeholders who must be involved.

- **Practitioners.** A RHIO's success depends on the willingness of physicians, nurses, pharmacists, and other caregivers to embrace health IT. Wired hospitals, healthcare networks, and physician offices will attest that resistance from practitioners, while practically inevitable, is less a reaction to technology and more likely derived from cultural factors, such as lack of understanding about project goals, lack of time, and loyalty to historic care practices.

- **Healthcare provider organizations.** Developing networks at the community or regional level will provide significant benefits from sharing individual health information across disparate organizations, but it also will require these independent – and often competing – organizations to work collaboratively. In addition to the interoperability, security, and

legal issues involved in connecting providers, RHIOs must address possible cultural aversions to working with a cross-town competitor.

- **Employers.** At the end of the day, employers foot the bill for the majority of the nation's healthcare expenditures. Not only do they have an incentive to push for a modernized system because of the dollars it saves, they must drive transformation because the lives and health of their employees is at stake. Employers must leverage their purchasing power to move providers, health plans, and consumers to change. Participating in health information exchanges is an important way to do this.

- **Health Plans and Payors.** While much of the discussion of health IT focuses on the cost savings to providers and provider organizations, payors will also benefit substantially from a health information infrastructure.[30] Health plan engagement in RHIOs specifically, and health information technology generally, has been limited at best. But payors are starting to become engaged participants in RHIO efforts around the country, including CalRHIO, HealthBridge, and MA-SHARE. They must become more engaged if we are to succeed.

- **Consumers.** Consumer and patient support is critical to the adoption of health IT in the United States. As consumers, taxpayers, and voters, individuals will drive private and public healthcare stakeholders to make health information networks a reality. Healthcare leaders must consciously educate patients about the value of EHRs, and address concerns about privacy, security and other issues.

Fortunately, to reach the goals of tomorrow, healthcare institutions can draw on change management solutions developed by today's healthcare technology pioneers. Some universal solutions cited by wired providers readily apply to promoting acceptance for health information networks among regional stakeholders and patients, as well.

- **Enlist clinicians in decision-making.** To ensure that health IT successfully meets the needs of practitioners, it is essential to involve physicians, nurses, pharmacists, and other clinicians at every step of an implementation project – from system selection to user training. Technology that supports EHRs, computerized physician order entry, online nursing documentation, and other functionality is not plug-and-play; these systems are highly sophisticated and should be tailored to effectively support and enhance workflow, open channels of communication, and unlock doors to useful information.

  Likewise, clinicians must contribute to decision-making for regional networks to ensure that these initiatives will realistically enable practitioners to provide safer, higher quality care, and will be embraced by the provider community.

- **Educate the public about the benefits of health information exchange.** Consumers and their advocates need to have a place at the table. On the one hand, consumers of healthcare want the efficiency and convenience they are accustomed to in other facets of their daily life – the ability to communicate with their doctor via e-mail or check test results online, for example. On the other hand, patients also have some very real concerns about how the privacy of their medical information will be protected once electronic health information exchange is the norm. Educating patients about the steps RHIOs will take to safeguard their information, as well as the very real improvements that will accrue in terms of patient safety and quality of care, can help to increase acceptance among this critical audience.

- **Give stakeholders a clear view of the continuum of care with comprehensive data.** The ability to see the patient's medical history across the entire continuum of care is a

significant payoff for clinicians making the switch to EHRs from paper records. However, a physician's or nurse's ability to see the complete picture is directly proportional to the amount of information that an organization puts online.

The same holds true at the regional level, according to Dr. John Haughom from PeaceHealth. When the organization was building its CHR to support patient care across three states, independent physicians watched and waited to see how the project would progress before signing on. Once the organization reached a critical mass of information, however, enthusiasm from the community increased significantly. Today, non-employed physicians and their office staff members make up more than half of PeaceHealth's 16,000 authorized users.

For its patients, PeaceHealth also is making an ever-greater amount of useful information and services available online. The organization launched an online patient portal primarily focused on front-office functions, enabling patients to refill prescriptions and request referrals. Recently, PeaceHealth began allowing patients to access their individual charts, and is moving toward a long-term goal of shared care plans that allow caregivers and patients to collaborate on care decisions.

- **Communicate outcomes.** Once a provider begins to see definable results with its new health IT system, sharing those with the staff will reinforce support. A nurse or physician who can see that the new system is helping to reduce potential medical errors or is freeing up more time to spend at the bedside will become more excited about and supportive of the technology. Organizations should identify a variety of metrics to demonstrate positive outcomes.

  RHIOs also have significant opportunities to measure and communicate improvements in patient care, clinician efficiency, cost-savings measures, and the health of local populations. By setting aggressive but achievable goals and then using the data that is available from networks of EHRs, RHIOs can prove to stakeholders, clinicians and importantly – consumers – the value of connecting caregivers.

- **Address issues of competition between healthcare organizations.** One approach to ensuring that competition does not inhibit the growth of a RHIO is to identify or create an impartial facilitator for regional initiatives. For example, as an independent entity, CalRHIO provides a neutral environment for healthcare stakeholders from throughout California to discuss best practices, ongoing projects, and strategies for exchanging data between organizations. Similarly, the Indiana Network for Patient Care works with a neutral clearinghouse, the Regenstrief Institute, to standardize data.

  Alternatively, the participants in some RHIOs are overcoming competitive barriers by finding common ground in shared goals. Recognizing the need for infrastructure that will help prevent a public health crisis or bioterrorism incident, Nebraska's leading hospitals collaborated to develop the Nebraska Statewide Telehealth Network. The statewide network not only garnered support – and resources – from hospitals, but smaller provider organizations, health plans, state government and state medical associations also are on board.

This work will culminate in the creation of a 21st Century Intelligent Health System, a health and healthcare system that is centered on the individual, not the provider or hospital. Prevention and wellness are fundamental priorities. Care is driven by outcomes, not by volume. Consumers own their data and have a right to know cost and quality information. Innovation is rapid. The dissemination of knowledge is in real-time.

All of this must be built upon an electronic system because our current paper-based system contributes to medical errors and hampers clinician efficiency.

Health information exchanges are a promising foundation on which to build such a system. It will require collaboration, significant legal and regulatory reform, consumer education, and technical marvels. But it is possible, and it most certainly is needed.

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